DOCUMENT RESUME

ED 425 625

EF 005 130

AUTHOR	Hattis, D. B.; Krimgold, F.; Green, M.
TITLE	Seismic Mitigation Strategies for Existing School Buildings.
PUB DATE	1994-00-00
NOTE	99p.
PUB TYPE	Reports - Research (143)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Earthquakes; *Educational Facilities Improvement; Elementary Secondary Education; Long Range Planning; Program Descriptions; *Public Schools
IDENTIFIERS	*Retrofitting; *Risk Reduction

ABSTRACT

California provides the paradigm for lessening devastating earthquake damage in U.S. buildings. This document examines specific examples of the seismic mitigation process, a process showing that seismic retrofit in existing schools in other parts of the country are possible and could lead to more general seismic rehabilitation in other buildings. The report suggests that school facilities at risk for earthquake damage need a strategy of integrating the planning and implementation of seismic strengthening into the overall process of facility maintenance and capital improvement planning. Such a strategy is already being implemented in eight school districts in various regions of the United States. Findings from these projects suggest that jurisdictions in the United States can be categorized by a gradient of seismic awareness and the ability to act on it. California and Seattle are viewed as being the most aware and active states. The majority of the document contains appendices providing detailed case studies of the seismic mitigation activities, funding, and legal issues within the following school districts: Memphis (Tennessee); Blytheville (Arkansas); Seattle (Washington); Portland (Oregon); Ogden (Utah); and New York City (New York). (GR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
● Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 425 625

SEISMIC MITIGATION STRATEGIES FOR EXISTING SCHOOL BUILDINGS

D. B. Hattis[I], F. Krimgold[II] and M. Green[III]

ABSTRACT

Upgrading of schools appears to be the highest priority mitigation measure in most seismically active areas of the country, and would appear to be the logical starting point for local earthquake hazard mitigation. However, very little has been accomplished to reduce structural earthquake hazards in schools outside of California. California provides the paradigm for earthquake hazard mitigation in buildings in the U.S. It started with schools. The 1933 Field Act established seismic design requirements in new school buildings. The Garrison Act of 1939 and the Greene Act of 1967 addressed seismic safety in existing schools. By 1977, a program to retrofit all pre-1933 schools had been completed with a few exceptions. Other building types followed, and the success achieved with schools is considered by many to have been a primary catalyst. The hypothesis underlying the project discussed in this paper is that it is possible to initiate programs of seismic retrofit in existing schools in other parts of the country, including Seismic Zones 2 and 3. Such programs could subsequently lead to more general seismic rehabilitation. The problems of how, learning from the California experience, to achieve seismic safety in existing school buildings elsewhere, and of how to pay for it, are the subject of this project. What is needed for school facilities in Seismic Zones 2 and 3 is a strategy of integrating the planning and implementation of seismic strengthening into the overall process of facility maintenance and capital improvement planning. Such a strategy, is being developed in concert with eight school districts in various regions of the country.

EF 005 130

[I] President, Building Technology Inc., Silver Spring, MD

[II] Associate Dean for Research and Public Service, College of Architecture and Urban Studies, Virginia Polytechnic Institute and State University, Alexandria, VA

[III] President, Melvyn Green and Associates, Inc., Torrance, CA

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
David B. Hattis
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
1

INTRODUCTION

In 1988 the present authors initiated work on a project entitled "Financial Incentives for Seismic Rehabilitation of Hazardous Buildings" under the existing buildings component of FEMA's National Earthquake Hazards Reduction Program (NEHRP) [1]. Building Technology Inc. was the prime contractor. FEMA anticipated that a variety of available financial incentives would be identified, and, through a series of workshops, local jurisdictions would be shown how to use them to initiate local seismic rehabilitation programs. As the work progressed it quickly became clear that FEMA's anticipations were far too sanguine. No financial incentives of any kind were available outside California for seismic rehabilitation, and financial incentives for other aspects of building rehabilitation were unlikely to be shifted so as to encourage seismic rehabilitation. Nevertheless, opportunities to initiate local actions that could lead to seismic rehabilitation were found in many localities. These opportunities were pursued in "action planning" sessions in the appropriately revised workshops. One of these opportunities was found in most of the localities -- the issue of seismic safety in existing school buildings.

There are several reasons for this. Experience of recent earthquakes in Mexico, Armenia, the Philippines, and Iran has shown that inadequately designed schools can be a major contributor to loss of life and suffering. In this country it is generally known that much of the public school building stock is obsolete and inadequate. It has been reported that 25% of school buildings in the U.S. are in "inadequate condition" and an additional 33% are "only adequate" [2]. Additionally, school buildings are identified in many local emergency response and recovery plans as shelters and distribution centers. Their continued use immediately following an earthquake is of vital importance to emergency managers and planners.

Upgrading of schools appears to be the highest priority mitigation measure in most seismically active areas of the country, and would appear to be the logical starting point for local earthquake hazard mitigation. However, very little has been accomplished to reduce structural earthquake hazards in schools outside of California.

California provides the paradigm for earthquake hazard mitigation in buildings in the U.S. It started with schools. The 1933 Field Act established seismic design requirements in new school buildings. The Garrison Act of 1939 and the Greene Act of 1967 addressed seismic safety in existing schools [3]. By 1977, a program to retrofit all pre-1933 schools had been substantially completed. Other building types followed, and the success achieved with schools is considered by many to have been a primary catalyst. Seismic safety in new construction has been achieved through progressive improvements of the Uniform Building Code. Seismic retrofit of existing buildings has only recently begun to be addressed. Los Angeles first passed an unreinforced masonry (URM) building ordinance, Division 68, in 1981 (now Division 88). The State enacted the URM building law in 1986 (Senate Bill 547) almost 20 years after the Greene Act.

The hypothesis underlying the project discussed in this report is that it is possible to initiate programs of seismic retrofit in existing schools in other parts of the country, including Seismic Zones 2 and 3. Such programs could subsequently lead to more general seismic rehabilitation. The problems of how, learning from the California experience, to achieve seismic safety in existing school buildings elsewhere, buildings constructed before the adoption of modern seismic design codes, and of how to pay for it, are the subjects of this project.

The overall costs of such an undertaking are not trivial. In Salt Lake City, which has 40 schools and a current repair and improvement budget of about $3 million per year, the cost of seismic retrofit of schools was estimated at about $30 million in 1989. When combined with other code improvements, program changes etc., the total capital improvement program was estimated at $50 - $80 million. In the State of Washington, the costs of modernization and seismic strengthening of pre-1965 schools have been estimated by the Superintendent of Public Instruction at $1.1 billion.

The Federal Emergency Management Agency (FEMA) has reported that the costs per square foot to retrofit seven Southern California schools between 1949 and 1967 varied between $12.60 and $92.77, with a mean of $52.21 [4].

With costs of this magnitude, school administrators outside of California, who deal with aging building inventories and a variety of unfunded federal and state mandates, and who have a tradition of treating discrete facility problems one at a time, have been reluctant to take up the cause of seismic strengthening, or even to become adequately informed about it.

However, time and planning may be on the side of seismic mitigation. Earthquakes are not an imminent hazard. The recurrence periods are measured in decades and centuries. With proper timing of the retrofit actions they very likely become feasible.

Instead of developing discrete, mandated seismic retrofit programs such as Los Angeles' URM law, which has been the typical approach and which has worked in California, what is needed for school facilities in Seismic Zones 2 and 3 is a strategy of integrating the planning and implementation of seismic strengthening into the overall process of facility maintenance and capital improvement planning.

The development of such a strategy is timely, from the perspective of both intersecting spheres of interest -- school facility management and earthquake hazard mitigation. School facility planners are among those leading the way in the development of long-term facility maintenance approaches as a solution to the problem of deferred maintenance. On the other side there is strong evidence, borne out by the California experience, that seismic strengthening of schools can become the catalyst to more general seismic strengthening in the community. The development of the strategy in this project, a strategy which must address both the physical measures of increasing seismic resistance and the organizational, financial and planning processes necessary to initiate and support these measures, will help bridge the present gap between these two spheres. Earthquake engineers and school facility maintenance planners will be able to cooperate to their mutual satisfaction and that of society as a whole.

PROJECT METHODOLOGY

The project was divided into three component parts. The first examined the status of seismic exposure and current maintenance and capital improvement procedures of school facilities in eight selected jurisdictions (in seven States) in Seismic Zones 2 and 3. It included extensive field data collection from key persons involved in the various aspects of local school facility management, funding and operations. Reference was also made to budget documents, maintenance plans, capital improvement plans and similar documents.

The second component involved the review and analysis of the California experience of seismic hazard reduction in schools over the past 50-plus years, to better understand the economic, political, and administrative factors which contributed to the program's completion and success. It is based primarily on documents and records made available by the Structural Safety Section of the Office of the State Architect in the Department of General Services, and the Office of Local Assistance and the School Facilities Planning Division in the Department of Education, State of California.

The third component was the development of proposals for economically feasible and socially acceptable strategies for seismic hazard reduction in existing schools, based on the analysis of current maintenance and capital improvement procedures and the specialized California experience. The recommended strategies were developed in conjunction with key professionals from the field of school facilities management.

The authors were principal investigators on the project. The American Association of School Administrators and the Council of the Great City Schools were both participants in the project.

The ongoing analysis of seismic exposure and current maintenance and capital improvement procedures is described in the balance of this report. The California experience of seismic hazard reduction in schools is reported separately under the title *Task 4 -- The Review and Analysis of the Experience in Mitigating Earthquake Damage in California Public School Buildings*, dated Summer 1993 . Economically feasible and socially acceptable strategies for seismic hazard reduction in existing schools are presented separately in two reports entitled *Facilities Management of Existing School Buildings -- Two Models*, and *Existing School Buildings -- Incremental Seismic Retrofit Opportunities*, dated December 1994.

SELECTION OF STUDY SCHOOL DISTRICTS

Criteria for the selection of the study school districts reflect the following parameters:

- Seismicity
- Geographic location
- Size of jurisdiction
- Age of school building stock
- Extent of capital funding from the State
- Extent of maintenance, repair and rehabilitation work
- Interest in seismic rehabilitation

A description of the project and a three-page District Selection Instrument/Questionnaire (Attachment A) soliciting information relating to the selection parameters were mailed to the Superintendents of 28 school districts in the following States: Alaska, Arizona, Arkansas, Idaho, Indiana, Kentucky, Massachusetts, Missouri, Nevada, New Hampshire, Oregon, South Carolina, Tennessee, Utah, Washington, and the Commonwealth of Puerto Rico. Twenty-one districts responded and included the requested information. (Nineteen of the responses are summarized in the matrices included in Attachment B.) Eight districts were selected and visited (Memphis, TN; Blytheville, AR; Seattle, WA; Portland, OR; Concord and Hampton, NH; Ogden, UT; New York, NY). Table 1. includes some of the principal characteristics of the eight selected jurisdictions. Fairbanks, AK, which was not selected for study would have been of interest because the State provides 70% of capital improvement funds and 75% of maintenance funds.

TABLE 1. District characteristics

	Memphis	Blytheville	Seattle	Portland	Concord	Hampton	Ogden	NewYork
pupils	107,000	4,487	44,500	56,282	5,100	1,160	12,589	952,151
$/pupil	3,300	2,872	6,400	3,757	6,153	6,491	2,980	~3,900
# bldgs	172	9	100+	126	11	3	26	1,053
av. age	40	30	50	65	52-62	50	38	56
eq zone	2-3	3	3	2*	2	2	3	2
% cap. funding state	0	0	3	0	0	0	0**	25
% maint. funding state	7.4	<50	0	0	0	0	75***	0

* Western Oregon, including Portland, is being upgraded to Seismic Zone 3.

** Under recent legislation, Utah may contribute toward districts' capital improvements.

*** 75% is average for entire state. Under equalization formula, Ogden is a donor district, not a recipient of state funds.

FINDINGS

Memphis (Attachment C)

Discussions were conducted with the following Memphis City Schools personnel: Assistant Superintendent for Business and Facilities, Director of the Division of Financial Services, Director of the Division of Plant Maintenance, Coordinator of the Office of Security Services (the emergency manager), and Board Architect (reporting directly to the Assistant Superintendent). Additional discussions were conducted with the Memphis and Shelby County Building Official, and Director of the Emergency Management Agency. Several Memphis schools were visited, and a large variety of documents were obtained.

Memphis has adopted seismic design requirements for new buildings very recently and after prolonged debate. Seismic retrofit of existing buildings is not yet on the public agenda. Nevertheless seismic awareness in Memphis is quite high.

As a result of the conviction and efforts of the Board Architect, Memphis City Schools voluntarily designed recent buildings to resist seismic loads, before this was required by the State Fire Marshal. The Board Architect is currently participating in a strategic planning effort initiated by the recently appointed Superintendent. As part of this effort he is developing a process for the physical evaluation of schools, in which "seismic resistance" is one of 16 categories of evaluation attributes, and can account for up to 200 points out of a total of 2,600. Since nearly half of the schools in Memphis are constructed of unreinforced masonry, this physical evaluation activity, if implemented, could eventually become the basis for planning for seismic retrofit.

Capital improvements of Memphis City Schools can be funded by Memphis city bonds, which do not require a referendum. Thus a seismic retrofit program could be initiated and funded in Memphis as a purely management decision.

Blytheville (Attachment D)

Discussions were conducted with the Superintendent of Blytheville Public Schools and with the Business Manager, who also serves as the Emergency Management Coordinator of Mississippi County. Several of Blytheville's schools were visited.

Seismic design of new and renovated buildings is required in Arkansas by a recently passed State law. While a recently built school was voluntarily designed to resist seismic forces, the law's impact has not yet been felt in Blytheville schools.

While everyone in Blytheville "has felt a shake", while earthquake awareness is generally high, especially in the wake of the Browning prediction, and while Blytheville classrooms have earthquake emergency kits, nobody is discussing seismic retrofit of any kind.

School capital improvements, including seismic retrofit, could be funded by a bond issue, which would require voter approval.

Seattle (Attachment E)

Discussions were conducted with the Acting Director of Facilities Development and Construction at Seattle Public Schools and several of his staff, and with the Risk Manager of Seattle Public Schools. Discussions were also conducted with a senior staff person at the Seattle Department of Construction and Land Use (the building department), a staff person with Seattle Emergency Management, and the present and former Washington State School Architect. Extensive documents and reports pertaining to Seattle schools were obtained, and several schools were visited.

While the State has been analyzing seismic safety in Washington schools for several years, the impetus for seismic retrofit in Seattle has been generated from within Seattle Public Schools. Seattle appears to lead all jurisdictions outside of California in addressing the seismic vulnerability of its schools.

The Puget Sound area was affected by two major earthquakes in the past 50 years -- 1949 (Magnitude 7.1) and 1965 (Magnitude 6.9). These resulted in 15 deaths and extensive property damage. Ten schools were reportedly damaged in the 1949 earthquake and were later destroyed. Two of these were in Seattle. Other Seattle schools were damaged in 1949, triggering some seismic rehab work in the early 1950s. This reportedly consisted of tiebacks of masonry facade elements to the wood structures.

Systematic seismic mitigation in Seattle schools began in 1977 with a survey of the most hazardous buildings. By 1979 the imminent seismic hazards in all Seattle schools were identified. A ten-year capital improvement plan was approved by the Board in 1981. This led to a seismic analysis of every building, and to structural improvements at 20 schools in the 1980s, as well as the modernization or replacement of 15 additional schools between 1986 and 1991. The total cost of the latter program was about $140 million, of which about $40 million were State funds.

Recently, the Board approved a Facilities Master Plan to the Year 2010, and a related Capital Improvement Program to the year 2000. The latter includes the modernization, preservation or replacement of 38 schools, at an estimated cost of $795 million, of which $695 to be obtained through a 15-year bond measure. Of the six criteria established by the Board for project selection and order, "seismic conditions" accounted for the most (30%). Unfortunately, the bond measure was turned down by the voters in September and November of 1992. It is unclear at this time how this defeat will affect Seattle's incremental approach to seismic retrofit begun in the 1970s.

Portland (Attachment F)

Discussions were conducted with the following Portland Public School personnel: Superintendent, Chief Financial Officer, Director of the Physical Plant Division, and Director of Risk Management. Additional discussions were conducted with the City of Portland Emergency Coordinator and Bureau of Buildings senior staff, with planners at Metro, the Metropolitan Service District (the regional planning agency), with the Oregon Emergency Management Earthquake Program Coordinator, and with the chairman of the Oregon Seismic Safety Policy Advisory Commission (OSSPAC). Several documents were obtained and several schools were visited.

Earthquake planning in Oregon and in Portland is currently dominated by the recent geologic and seismologic studies which have significantly modified understanding of seismic hazard in the Pacific Northwest. This is leading to a change in the building code's map upgrading western Oregon from Seismic Zone 2B to 3.

Earthquake awareness is clearly in a state of change. It is estimated that 75% of the public have heard about the earthquake hazard. Fewer believe in it. While state and local government agencies are generally aware of the threat, only a handful of State legislators reportedly take it seriously. The level of awareness of the business community is probably lower than that of the government. Five years ago the Portland city fathers would reportedly have laughed at the mention of earthquake hazard. Today it is recognized. Earthquake awareness in Portland reportedly started with earthquake training in the public schools.

Earthquake planning in Portland is progressing on two fronts. First, the Portland emergency management plan is identifying specific school buildings with specific shelter functions. Second, Metro adopted an Emergency Management Work Plan on Earthquake Preparedness in 1991, and is currently working on an Earthquake Scenario Pilot Project covering an area within Portland.

Within Portland Public Schools the new Superintendent has directed that a strategic capital improvement plan be extended to five years. The Plan Facility Management Program currently underway will include a seismic analysis of buildings. Overall, Portland Public Schools seem to be embarking on a comprehensive, well supported process of planning that could lead to seismic retrofit, if it made sense.

New Hampshire

Discussions were carried out in two jurisdictions, Concord and Hampton. In Concord: Assistant Superintendent -- Finances, Concord School District, Chief Building Inspector, and Fire Chief (emergency manager). In Hampton: Superintendent and Business Manager of School Administrative Unit No. 21 (which includes Hampton), the Facility Manager of the Hampton School District, Town Manager and Emergency Manager, and the Building Officer, Town of Hampton. Additional discussions were carried out with the

Earthquake Coordinator, State Office of Emergency Management, and Consultant on School Construction and Finance at the State Department of Education.

In New Hampshire earthquake planning is focused on education and raising awareness. Earthquake risk is far from anyone's mind, and seismic mitigation is not currently an issue.

Funding of school capital improvements is entirely local, and in the case of Hampton, is voted on by the public at a town meeting. The only way that incremental seismic strengthening could be accomplished is in the form of multi-hazard mitigation, since hurricanes and high winds are more immediate hazards.

Ogden (Attachment G)

Ogden school district personnel are well aware of the seismic vulnerability of all of their buildings. Nevertheless, pleading inadequate resources, (poverty, even), they seem reluctant to initiate even minimal analysis of the problem, let alone to discuss mitigation and retrofit. Despite this, a recent reroofing of a high school included the addition of wall anchors, apparently at the suggestion of the designers.

This voluntary approach may be superseded when a recent statewide code change takes effect. It states in part:

> "Buildings constructed prior to 1975 with parapet walls, cornices, spires, towers, tanks, signs, statuary and other appendages shall have such appendages evaluated by a licensed engineer to determine resistance to design loads specified in this code when said building is undergoing reroofing, or alteration of or repair to said feature.
>
> ...When found to be deficient because of design or deteriorated condition, the engineer shall prepare specific recommendations to anchor, brace, reinforce or remove the deficient feature."

New York City (Attachment H)

New York City has initiated a major and comprehensive capital improvement program. All of its buildings are being inspected and evaluated. Currently, seismic vulnerability is not part of the evaluation process, and seismic mitigation is not being programmed.

However, a proposed new seismic building code (based on the Uniform Building Code) is before the City Council. If and when it is adopted, seismic design of new buildings and seismic mitigation in existing buildings will be on the agenda of New York Public Schools.

SUMMARY

From the findings it appears that jurisdictions in the U.S. can be categorized by a gradient of seismic awareness and the propensity to act on it. California is most aware and active, followed by Seattle. New Hampshire is initiating awareness. The rest can be arrayed between. Yet seismic safety and seismic retrofit of existing schools can become an important issue throughout. The strategies for including incremental seismic retrofit in schools must be useful to jurisdictions with all degrees of awareness and activity.

ACKNOWLEDGMENTS

This material is based upon work supported by the National Science Foundation under Grant No. BCS-9117732.

REFERENCES

1. Building Technology Inc., Silver Spring, MD. Financial Incentives for Seismic Rehabilitation of Hazardous Buildings -- An Agenda for Action, Volumes 1, 2, and 3. FEMA 198 & 199, 1990. FEMA 216, 1991.

2. National Education Writers Association. Wolves at the Schoolhouse Door. Washington, DC, 1989.

3. Bureau of School Planning, California State Department of Education. Cracks in the Belfry. Sacramento, CA, 1969.

4. Englekirk and Hart Consulting Engineers, Inc., Los Angeles, CA. Typical Costs for Seismic Rehabilitation of Existing Buildings, Volume I -- Summary (FEMA 156) and Volume II -- Supporting Documentation (FEMA 157), 1988.

ATTACHMENT A

DISTRICT SELECTION INSTRUMENT/QUESTIONNAIRE

1. CHARACTERISTICS OF SCHOOL DISTRICT

a. How many students are in the system? __________

b. Is the district (check one)
Urban _____
Suburban _____
Rural _____

c. What is the expenditure per pupil per year? __________

d. What was the Capital Budget for 1991-92? __________

2. CHARACTER OF THE BUILDING STOCK

a. How many school buildings are owned by the school district? __________

b. What is the average age of school buildings in the district? (approximate) __________

c. What % of buildings were built

Before 1920 _______
1920-1940 _______
1940-1960 _______
1960-1980 _______
1980-1992 _______

3. EARTHQUAKE CONSIDERATIONS:

a. What percentage of school buildings are unreinforced masonry? __________

b. What percentage of school buildings were built before any seismic design provisions were included in local building code? __________

c. What earthquake zone is the district in? __________

d. Has any action been taken to evaluate seismic risk in school buildings? __________

e. Has any action been taken to mitigate seismic risk in school buildings? __________

4. FACILITIES PLANNING AND MAINTENANCE:

a. Does your district have a department of Facilities Planning and Maintenance? __________

b. If so, what is it called? ____

c. What is the Building Maintenance Budget for 1991-92? __________

d. Do you have a strategic or long-range plan for facilities (Capital Improvement Plan)? __________

** If so, please return a copy with this questionnaire.**

e. Do you have a systematic plan for maintenance (Maintenance Schedule)? __________

** If so, please return a copy with this questionnaire.**

f. What % of new construction budget is local? __________

What % of new construction budget is state? __________

g. What % of capital improvement budget is local? __________

What % of capital improvement budget is state? __________

h. What % of maintenance budget is local? __________

What % of maintenance budget is state? __________

i. What % of total budget is facilities? __________

j. What % of facilities budget is maintenance? __________

k. Have you carried out an asbestos abatement program? __________

l. What is the estimated cost of the asbestos abatement program? __________

m. Have you carried out a weatherization program? __________

n. If so, what is the estimated cost of the weatherization program? __________

o. Have you carried out a re-roofing program? __________

p. If so, what is the estimated cost of the re-roofing program? __________

q. Have you carried out a lead abatement program? __________

r. If so, what is the estimated cost of the lead abatement program? __________

s. Have you carried out an accessibility improvement program? __________

t. If so, what is the estimated cost of the accessibility program? __________

u. Have you carried out a facility program to overcome programmatic obsolescence (modernization)? __________

v. If so, what is the estimated cost of the modernization program? __________

w. Have you carried out a program addressed to deferred maintenance? __________

x. If so, what is the estimated cost of the deferred maintenance program? __________

y. Have you demolished or abandoned obsolete buildings in the past ten years? __________

z. If so, how many? __________

ATTACHMENT B

	Ptld	Slvd	Seat	Lasv	Mmph	Shlb	Cncrd
students	56282	12000	44,500	130000	107000	41000	5100
dist/tpe	u	s/r	u	u/s/r	u	s	u
$/pupil	3757	3600	6400	4100	3300	3200	6153
c. bdgt	2.8m	10.3m	15.5m	120m	12.5m	4.8m	32m
bldgs	126	19	100+	164	?	95	11
av.age	65	22	50	25	40	20	52-62
<20	13	0	23	1	7.5	5	20
20-40	36	0	15	4	15.3	0	15
40-60	43	31.6	10	20	43	25	25
60-80	8	47.5	31	50	33	30	20
80-92	0	31	22	25	1	40	20
% urm	50	?	40-50	2	44	10	60
eq zone	3	3	3	3	2-3	2	2
eq actn	y/y	y/n	y/y	n/n	y/n	y/n	n/n
f/m deps	y	y/y	y	y	y	y/y	y
fac.pln	n	y	y	y	n	y	y
mant.pln	y	y	y	y	n	n	n
mant/bud	15.2m	2.6m	6.3m	10m	14.6m	3m	2m
mant/bd%	7.2	6	2.2	1.9	4.1	2.3	6.4
St.imp %	0	0	0	0	0	0	0
St.mnt %	0	98	0	39	7.4	40	0
demol #	6	?	5-7	0	6	1 clsd	2

	Tucs	Stls	Pctl	Hmptn	Chlls	Jsbro	Chlst
students	56600	41234	13300	1160	660	4886	46318
dist/tpe	u	u	u	u	r	s	u/s/r
$/pupil	3900	5473	2591	6491	4400	3007	4795
c. bdgt	7m	33.67m	3.22m	253k	2.5m	408k	12.7m
bldgs	127	149	44	3	6	37	72
av.age	25	75	30	50	11	25.5	~30
<20	4	40	5	0	0	3	0
20-40	11	30	5	25	0	2	40
40-60	39	22	35	60	1	30	4
60-80	39	8	45	15	1	35	50
80-92	5	0	10	0	4	30	6
% urm	61	90	40	70	0	100	100
eq zone	3	N.Mad	unkn?	2	mod(?)	3	2
eq actn	y/y	y/y*	n/n	n/n	y/y	n/n	y/y
f/m deps	y/y	n(?)	n	y	n	y	y
fac.pln	y	y	n	y	n	n	y
mant.pln	n	y**	n	y	n	n	y
mant/bud	6.37m	33m	935k	531k	-	265k	5.27m
mant/bd%	2.9	14.6	2.7	7		1.8	2.4
St.imp %	5	26	10	0	0	0	10
St.mnt %	50	N/A	70	0	0	0	0
demol #	2	41	1	0	1	0	14

* Under development for new construction

** Under development

	Slcty	Frbks	Ogden	IronCo	Blyvl		
students	24355	15396	12589	5600	4487		
dist/tpe	u	u	u	r	u+r		
$/pupil	31037	6291	2980mx	2800	2872		
c. bdgt	3.4m	14.9m	8.6m	1.6m	211k		
bldgs	40	33	26	14	9		
av.age	41	23	38	37	30		
<20	10	0	7.7	7	0		
20-40	7.5	3	7.7	21	10		
40-60	42.5	33	38.5	36	60		
60-80	32.5	33	38.5	21	20		
80-92	7.5	30	0	14	10		
% urm	70	20	4	14	90		
eq zone	3	3	3	2B	3		
eq actn	y/y	y/n	n/n	y/n	y/y		
f/m deps	y	y/y	y	n/y	n		
fac.pln	y	y	?	y	y		
mant.pln	n	y	?	y	y		
mant/bud	2.7m	12.7m	?	150k	?		
mant/bd%	0.36	13.15		0.96			
St.imp %	0	70	?	0	0		
St.mnt %	0	75	donor	60	>50		
demol #	3	3	1	0	1		

ATTACHMENT C

MEMPHIS CASE STUDY

October 26, 1993

I. DISTRICT INFORMATION

The Memphis City Schools serves the City of Memphis, Tennessee and parts of adjoining Shelby County. It has a student population of approximately 105,000 students. The balance of Shelby County, consisting of approximately 41,000 students, is served by a different district.

There are 160 schools in the district housed in 536 buildings (approximately 18 million square feet). Of the schools 104 are elementary schools and 48 secondary schools. Vocational and special education schools make up the balance. Memphis City Schools is an urban school district with a generally older building stock, the average age of the buildings being about 40 or more years. Approximately 23% of the schools are over 50 years old, 43% were constructed between 1940 and 1960, and 33% between 1960 and 1980. Over 60% of the schools are one-story, and no Memphis schools are over three. About 99% of the school buildings were constructed before there were any seismic regulations in the local building code, and about 44% are estimated to be of unreinforced masonry (presumably load bearing) construction, and many of the others are brick veneer. Six schools have been demolished or abandoned in the past ten years.

The annual school district operating budget for 1992-93 is about $400,000,000. Approximately 13.5% of the budget is assigned to maintenance and operations. Approximately $12.5 million is budgeted annually for capital improvements in a separate 5-year capital improvement project (CIP) fund.

Memphis City Schools self-insures for property and most liability risks. The only purchased insurance coverage is for school buses and for food in the cafeterias.

II. WHY MEMPHIS WAS SELECTED

The Central United States and the New Madrid Fault Zone have received particular attention under the National Earthquake Hazards Reduction Program (NEHRP), and it was the intention of this project from the start to include a district in that region. Two large urban districts were considered--Memphis and St. Louis. The latter's capital improvement program is currently a direct function of a court ordered desegregation action, which was felt to impose circumstances too unique for the purposes of this study. Memphis was selected for the following reasons:

- Recent adoption of seismic provisions in the building code.
- Growing local awareness of the earthquake problem.
- Expressed interest of Memphis City Schools facilities personnel in addressing earthquake problems.

The new Superintendent of Memphis City Schools had just taken office at the start of this case study (inaugurated July 1, 1992), and changes in senior staff responsible for finances and facilities occurred in the midst of the case study. These changes, and the retention of Memphis State University as a facilities consultant, significantly changed the development of a capital improvement program, as will be discussed later. These changes had no effect on the Memphis selection, or, if anything, reinforced it.

III. SEISMIC AWARENESS AND POLICY

Seismic Experience and Awareness

The worst sequence of earthquakes in the eastern U. S. in historic times was the great New Madrid earthquake of 1811-12. New Madrid is in the state of Missouri, and it has and continues to dominate thinking about seismicity in all the states bordering the Mississippi River from Illinois to Mississippi. Memphis is located about 40 miles southeast of the southern end of the New Madrid Fault Zone, which is at Marked Tree, AR. Memphis has had lesser earthquakes since the New Madrid earthquake.

There is a broad public awareness of the potential earthquake risk faced by Memphis and the Mississippi Valley. The Memphis and Shelby County Emergency Management Agency in recent years has emphasized public information on earthquakes. The "Browning Prediction" of a big earthquake did much to raise public awareness of earthquake potential in the region.

Emergency Management and Other Initiatives

The Memphis and Shelby County Emergency Management Agency has conducted several local earthquake exercises in recent years, and has participated in three federal exercises. Memphis City Schools was represented in the local exercises. Retrofit of existing buildings is not an emergency management priority in Memphis and Shelby County.

The Center for Earthquake Research and Information (CERI) at Memphis State University has conducted a number of research projects on buildings, risk, and the school building stock.

A recent study entitled *Inventory and Preliminary Vulnerability Assessments of Essential Facilities in Memphis and Shelby County*, funded by the USGS and completed in April, 1992 by Chang, Kung, Pezeshk and Yiak is an example of such a study. This report developed a vulnerability evaluation method for buildings and a GIS mapping base.

District Goals and Objectives

The Browning prediction had two effects on Memphis City Schools:

- Participation in a Shelby County survey of public facilities.

- Development of an "earthquake package" including videos, take-home information for students, drills and placement of emergency supplies (food in all schools, emergency generators in some).

The district also formed an earthquake long range planning committee. However, this committee has reportedly not met in some time.

The objective of Memphis City Schools, though not formalized in a plan (see further discussion below), is to improve seismic safety in schools as allowed by the realities of school budgets. For example, several new buildings were voluntarily designed and constructed to meet the requirements of the seismic provisions of the 1988 Standard Building Code even before it was adopted by the State Fire Marshal (see State Fire Marshal's role in next section) or by Memphis and Shelby County. Furthermore, since 1990 all major renovation work, such as air conditioning and suspended ceilings, has complied with code requirements for seismic design. Finally, improvements were made to science laboratories to limit the spill potential of chemicals falling off shelves during earthquakes.

In late 1990 the Memphis and Shelby County Emergency Management Agency conducted an earthquake preparedness survey of the schools. The survey identified the number of students and school personnel, stored food and water, medical supplies and communications. Additionally it requested information on the building construction, emergency shut-off valves, local medical and fire facilities and other physical plant questions; information on disaster plans for earthquakes, tornado, and fire; and information on non-structural mitigation measures needed.

While interesting, the survey results are probably unused. It appears, however, that it was a good training tool for school staff. They reviewed their plans and equipment and could identify needed training and plan development.

IV. REGULATORY BACKGROUND (CONTEXT)

General

Compliance with the Standard Building Code (SBC) is mandatory throughout the state of Tennessee. The edition to be enforced must be within six years of the current edition, which is critical for seismic design which became mandatory in the SBC only in the 1988 edition.

Memphis and Shelby County deferred adopting the seismic provisions of the 1988 SBC for several years. They were finally adopted in Memphis in early 1990 and became effective in April or May 1991. The adoption issue was debated extensively, with the economic impact of additional construction cost at the heart of the debate. Since Memphis appears to straddle the Seismic Zones 2 and 3 of the SBC seismic map, the debate centered on which seismic provisions to adopt. One side argued for the adoption of a Z-factor of 0.5 (which is the correct factor for the contour line between Zones 2 and 3, according to the SBC), while the other argued for a factor of 0.33 (which is slightly below the average factor for Zone 2). A compromise factor of 0.375, average for Zone 2, with the Zone 2 requirements was adopted. Non-structural design requirements were excluded, except for exterior walls and parapets.

Despite the adoption of Zone 2 requirements by both Memphis and Shelby County, both mayors (city and county) have reportedly stated that public buildings would be designed to Zone 3 requirements.

If and when Memphis adopts the next edition of the SBC, which includes the NEHRP provisions, this issue may come up again, or else Memphis would not be consistent with other national standards.

State Codes and Code Enforcement

School buildings in Tennessee are subject to compliance with the stricter of state or local codes. The state codes are enforced by the State Fire Marshal. The state code in effect is the 1988 edition of the SBC. The State Department of Education reportedly announced several years ago that state contribution to school district operating funds would be withheld for non-compliance with strict SBC seismic requirements, including Zone 3 in Memphis. As a result, the State Fire Marshal enforces Zone 3 requirements in Memphis.

School plans for new construction, additions, and renovation involving alteration of egress routes, fire ratings and type of construction are submitted to the State Fire Marshal for review. Submission is reportedly at the 95% completion stage. The review for seismic safety and structural compliance relies on the professional engineer's seal and a specially designed one-page form one must fill out.

Following any required corrections or changes the plans are returned to the school district, completed, and issued for bid. The successful bidder then applies for a building permit at the Memphis and Shelby County Office of Construction Code Enforcement. The extent of school plan review, if any, by this office is unclear. It is also not clear what review, if any, occurs in the case of minor renovation (which is not submitted to the State Fire Marshal).

Seismic design is required for additions, but retrofit has not been required by either enforcement authority (State Fire Marshal or Memphis and Shelby County) in connection with renovation.

Both the State Fire Marshal and Memphis and Shelby County reportedly carry out inspections of new construction and renovation work.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

Memphis City Schools does not currently have an organizational structure which concentrates responsibility for capital improvements. The responsibility lies with the Department of

Business and Facilities which is headed by an Assistant Superintendent. The department includes a Division of Plant Maintenance (which handles maintenance, reroofing, asbestos abatement, etc.) and a Division of Plant Operations (which may end up with the responsibility for radon abatement). There is also a Board Architect who reports directly to the department head.

The approach to capital improvement has so far been ad-hoc. Projects have been implemented "where the money is." Since Shelby County is involved in the funding of both city and county schools (see below) there is "some coordination" between the city and county systems in defining capital needs. Each system makes presentations on needs before a County Court (?), which is generally more interested in county schools, where new construction is required to meet growth needs. Memphis City Schools has a Capital Improvement Project Committee which has in recent years defined their needs in the areas of asbestos abatement and fire code compliance.

The boundary between capital improvement and maintenance in Memphis schools is fuzzy. Reroofing, for example, has been done under both categories ("whatever way you can get it"). However, maintenance planning is not well developed. There is no systematic inspection to identify maintenance needs. Each school's principal and building engineer makes requests and the Division of Plant Maintenance responds. Even roof replacements are not done on a fixed cycle, but in response to specific problems. Maintenance competes against "everything else" for funds, and it is vulnerable.

In contrast to this ad-hoc approach to facility management and planning, Memphis City Schools' asbestos abatement program is considered a national model. It is a seven-year program (1987-1994) budgeted at over $3 million per year. Supported by Federal loans and grants, it requires a management plan and extensive inspections, for which the Division staffed up with about 50 people. Inspections were initiated in 1988. Quick reinspections are done every six months, and complete reinspections every three years. The supervisors come from a construction background, but the inspectors for the most part do not.

In June 1992 district staff put together a summary of recent and projected capital improvement projects entitled Capital Improvement Projects and Additional Funding Needs. The budget for 1987-92 (or to 1993) was $93.5 million which included some land and new construction and almost $16 million in asbestos abatement. The projected budget for 1992-94 (or from 1991) was $49.2 million which included $10.4 million for new schools, $1.7 million for land, $5.25 million for asbestos abatement, and $1 million for "major roofing."

The new Superintendent has emphasized the need to do strategic planning for Memphis City Schools. Many personnel of the Department of Business and Facilities stated that this will lead to long range facility planning. The Board Architect developed a **School Physical Evaluation** document to provide condition assessments as a necessary first step in any strategic planning. The document is an amalgam of checklists developed by the Council of

Educational Facilities Planners International (CEFPI) with additional items developed at Memphis City Schools. The CEFPI checklist (and related total possible evaluation scores) consists of:

- The school site (100)
- Structural & mechanical (200)
- Plant maintainability (100)
- School building safety (200)
- Educational adequacy (200)
- Environment for education (200)

The Memphis City Schools additions are:

- Fire & life safety evaluation (200)
- Building characteristics (100)
- Operating cost (250)
- Acreage (50)
- Handicap (sic) access (200)
- Seismic resistance (200)
- Asbestos condition (100)
- Enrollment (200)
- City area strategy (200)
- Vitality of other school programs (100)
(emphasis added)

The total possible score for evaluation is 2600. The noteworthy inclusion of seismic resistance considers the following variables:

- Structural system
- Regularity of building shape and absence of soft story
- Building height
- Building cladding
- Egress
- Bracing of mechanical and electrical elements
- Pounding

This in-house effort has recently been superseded by the award of a Memphis City Schools contract to the College of Education at Memphis State University to perform a facilities survey. The objectives of the survey are:

> "...The intent...is the immediate generation of information relative to potential problem facilities and, in addition, to serve as a pilot project for further work. In this regard, the project is structured as a preliminary step for generating information in support of a complete system-wide assessment. Specific outcomes of this project will

include recommendations for: general building standards, the cost/effectiveness of maintenance and additions, alleviating building deficiencies, optimal school enrollment, utilization patterns, alternative enrollment arrangements, demographic futures, and grade and structural organization..."

The survey will be carried out on a sample of 25 schools. Memphis State project personnel have expressed their interest in including assessment of seismic risk in the survey.

Current maintenance activities include $55,000 for lead paint testing.

Recent square foot costs for renovation have been:

• New Construction	$41.00 (1-story) to $55.00
• Fire/Life Safety Renovation	$ 8.00
• Modernization (computers etc.)	$10.00
• Air Conditioning (self-contained unit ventilators)	$10.77
• Reroofing (per sq. ft. of roof)	$ 2.75-3.00
• Compliance with ADA (estimate)	$ 2.00

VI. FINANCIAL AND BUDGET ISSUES

School Budget Financing

The annual school district operating budget for 1992-93 is about $400,000,000. Approximately 13.5% of the budget is assigned to maintenance and operations, in proportions which could not be determined. Approximately $12.5 million is budgeted annually for capital improvements.

A large portion of school operational funding is provided by the state--approximately 47% of the budget. However these funds are quite restricted with little variations permitted by a school district. There is no state funding for construction and maintenance, with the exception of special programs and needs, none of which has been used for major renovation.

The balance of the budget and all funding for construction and maintenance is local, with both city and county as the sources. In Tennessee counties are responsible by law for school system capital improvements, to be allocated between districts on a pro rata basis. Therefore, Shelby County allocates capital improvement funds (from bond proceeds and from taxes) to Memphis City Schools at a ratio of 3 to 1. A county tax ("wheel tax") is divided between the two schools districts. An additional city tax supports Memphis City Schools. City and county property taxes, which have not been increased in seven years, account for 35% of Memphis City Schools budget. One half of the proceeds of a county sales tax is allocated to schools. This accounts for another 16% of the funding.

The county has a desperate need for new schools, so it has raised $125 million over the past five years in County bonds. Of these proceeds $93 million was allocated to Memphis City Schools (to cover the 1987-92 capital improvement projects). Additionally, the City of Memphis can float its own bonds, which does not require a public referendum (only local sales taxes require a referendum). Bond proceeds are used only for capital improvements and for "exceptionally major maintenance." (It is not clear whether the projected $49.2 million capital improvement budget for 1992-94, or some part of it, will be paid from county or city bond proceeds.)

As stated earlier, Memphis City Schools does not have a specific Capital Improvements Budget and a separate Maintenance Budget. The two have been intermingled for a number of years. This may have been the result of budget constraints that all schools suffered during the last two decades where most funds were used for operations, and maintenance was deferred.

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

Memphis City Schools' approach to self-insurance has an unusual operational characteristic. The district does not seem to be overly concerned about possible law suits. Instead it faces any liability claim head on and if they believe they are right, fight it in court. The deep pockets theory does not seem to be a major worry.

With regard to earthquake-related liability, the Memphis City Schools risk manager feels there is none "if they take action." Facility personnel feel that the liability would be managed if qualified, well-trained personnel did the work. In general, they are not concerned about the liability implications of learning more about the seismic vulnerability of the worst buildings.

VIII. SUMMARY AND OBSERVATIONS

Lessons Learned

1. Despite the rapidly growing awareness of earthquake risk in Memphis, planning for seismic mitigation of buildings has not been institutionalized in Memphis City Schools. However, one individual (the Board Architect) has been advocating mitigation within the system.

2. With the new district administration, strategic planning will be practiced in Memphis City Schools, and long range facility planning is likely to be a part of it.

3. The fear of liability will not be a constraint to approaching seismic mitigation and incremental retrofit.

Changes to Improve Seismic Retrofit

Memphis City Schools and its contractor Memphis State University should include earthquake vulnerability in the forthcoming facilities assessment effort. Then, incremental seismic improvements could be implemented if they knew exactly what to do. The costs for partial or incremental seismic retrofit are similar to current costs of other building improvements, and could probably be accommodated.

What Can Be Shared with Other Districts

There are two lessons which Memphis can share:

1. A single committed individual on the school district staff can become a seismic mitigation advocate and make a difference.

2. Seismic mitigation advocates should become part of the strategic planning efforts.

APPENDIX A

LIST OF INTERVIEWEES

Memphis City Schools:
  - Ray Holt, Assistant Superintendent, Business & Facilities (now retired)
  - J. Richard Walker, Director, Division of Financial Services (now retired)
  - W. R. Eissler, Board Architect
  - Clifford Burdick, Division of Plant Maintenance
  - Bob Raby, Office of Security Services

R. T. (Terry) Hughes, Memphis and Shelby County Building Official
Charles Bryant, Memphis and Shelby County Emergency Management
Tzyy-Shiou Chang, Center for Earthquake Research & Information,
  Memphis State University
Robert H. Beach, College of Education, Memphis State University
Mary Jane Cheatham, College of Education, Memphis State University

ATTACHMENT D

BLYTHEVILLE, ARKANSAS

CASE STUDY

October 22, 1993

I. DISTRICT INFORMATION

Blytheville is located in northeastern Arkansas, in the southern portion of the New Madrid Seismic Zone. The population of the city is about 25,000. The total enrollment of the Blytheville Public Schools is 4,487 (1991-1992).

Blytheville school facilities include one High School, two Junior High Schools, five Elementary Schools, and one Administration Building. Of these nine facilities, eight are considered urban, and one elementary school is considered rural. The Administration Building was built in 1926. Five of the facilities, including the High School, date from the period 1940-1960. Two were constructed during the period 1960-1980, and one, West Junior High School, was completed in 1988. One building was abandoned in the past ten years.

The total school budget in Blytheville for 1991-1992 was $12,288,042.00 (approximately $3,000 per student).

An estimated 90% of the buildings owned by the school district are unreinforced masonry. All of the buildings were built before any seismic design provisions were included in the local building code, although in the design of West Junior High School the architects voluntarily included seismic design.

Blytheville Public Schools has commercial property insurance which reportedly includes seismic hazard coverage. It also has general coverage for liability.

II. WHY THIS DISTRICT WAS SELECTED

Blytheville is located near the southern end of the New Madrid Seismic Zone (generally considered to extend to Marked Tree, Arkansas). According to current national seismic zonation, Blytheville is in Zone 3.

General awareness of seismic risks in the central United States has increased dramatically over the past decade, largely due to the efforts of the Central United States Earthquake Consortium (CUSEC). Recently, action has been taken in local jurisdictions in the area to incorporate seismic design criteria into local building codes for new construction. This relatively recent acceptance of seismic risk for new construction raises the question of what reasonable risk reduction measures can be considered for existing structures constructed prior to the adoption of seismic design provisions. Blytheville is a valuable representative of a relatively small school district in a newly designated Zone 3. Given the size of the Blytheville School enrollment, the administrative staff carries broad responsibilities. Facilities management is one of the many responsibilities of the Business Manager. Facilities planning and maintenance issues are handled by the Business Manager and the Maintenance Supervisor.

This scale of operation is typical of a large number of school districts in the United States which are located outside large urban areas. It is critical that risk assessment and mitigation procedures be developed which can be effectively administered within the resource constraints of an organization like Blytheville Public Schools.

III. SEISMIC AWARENESS AND POLICY

Seismic Experience

Blytheville is in the area assumed to have experienced extremely heavy shaking during the 1811-1812 New Madrid Earthquakes. Moderate shaking in the Blytheville area is reportedly a common occurrence. In the words of the Emergency Management Coordinator for Mississippi County, "Everyone has felt a shake."

Statewide Earthquake Awareness and Planning Efforts

There is general awareness of the potential for seismic activity affecting Blytheville. The Iben Browning prediction in the fall of 1990 significantly raised public awareness. Blytheville schools have initiated an assessment of "Non-structural" hazards in school buildings. Each school has an earthquake plan, and earthquake drills have been held. The schools are also intended to be used as post-earthquake service delivery points. Health care supplies are stored in the schools. Finally, an emergency communications system utilizing hand-held radios has been established for the schools.

The State of Arkansas has been an active participant in the CUSEC. The State of Arkansas Office of Emergency Services has an Earthquake Preparedness Supervisor who has coordinated a comprehensive effort to increase earthquake awareness, preparedness, and mitigation. CUSEC and the State Office of Emergency Services have assisted in the development of the "Non-structural Hazards" program, and the development of school earthquake plans. Additionally, the Arkansas Center for Earthquake Engineering Technology Transfer (ACEETT) established at the University of Arkansas, Little, Rock, has developed courses, training programs, and conferences on earthquake mitigation.

Two recent events may have significant impact on school facilities in Arkansas. First, on April 9, 1991 Governor Bill Clinton signed Act 1100 1991 titled "An Act to Safeguard Life, Health and Property by Requiring Earthquake Resistant Design for All Public Structures to Be Constructed or Remodeled within the Boundaries of This State Beginning September 1, 1991." This law is applicable to all structures that are open to the public, and is enforced by local building officials.

Section 4. of the Act establishes seismic design requirements on entities which "...shall construct, add to, alter, retrofit, or remodel...." structures (emphasis added). Section 2. of the Act contains the following definitions:

> " 'Add to' shall mean adding to existing buildings or structures more than four thousand (4000) square feet in gross floor area and all areas of increased building height.
>
> " 'Alter', 'retrofit', and 'remodel' means any alteration or repair of a building which when completed will increase the market value of the building by one hundred percent (100%) or more."

The seismic design requirements are those in the latest edition of the Standard Building Code (SBC), and they apply to the "structural elements" only. "Structural elements" are defined as "...all structural load carrying members ... required to transmit loads (forces) within the building or between the building and the ground."

Second, the Arkansas Department of Education, with the assistance of the State Office of Emergency Services, has been implementing a recommendation of the Governor's Task Force on Student Discipline and Safety that guidelines for earthquake safety in schools be developed. The guidelines will address three areas:

- preventive planning
- hazard identification
- student earthquake drills

Despite these activities, school personnel in Blytheville are not sanguine about the availability of State financial resources for local seismic mitigation in school facilities. This is attributed to the fact that seismic risk is confined to the northeastern portion of the State, and is not viewed as a Statewide problem.

IV. REGULATORY BACKGROUND

In Arkansas, the State Department of Education reviews all school building plans for compliance with educational standards. School plans are also reviewed by the State Fire Marshall for fire safety, and State Building Services for handicapped access. The local Building Code Official reviews plans for plumbing, electrical, and fire safety. Plans have to be certified by a registered engineer or architect. There ar no State inspections of construction, and the local inspection covers primarily plumbing and electrical work.

The city of Blytheville currently enforces the 1991 edition of the SBC.

Earthquake provisions would be enforced by the local building official based on the SBC and on Act 1100 (structural elements only). Potential conflicts between the SBC and Act 1100 in the area of definitions and scope have been identified. Their impact on school construction and rehabilitation is not known.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

With limited administrative resources, formal long-range facilities planning is difficult to accomplish in Blytheville. However, a long-range plan for roof maintenance is being undertaken. Long-range plans include scheduled additions to heating plant and scheduled roof repair.

Special projects for specific retrofit activities, funded with federal grants, have been undertaken by Blytheville Public Schools. For example, asbestos removal was funded with a grant from the Environmental Protection Agency, and energy conservation was funded with a grant from the Department of Energy. The asbestos removal project cost a total of $2,000,000. The weatherization/energy conservation program is estimated to cost approximately $100,000 per year.

Typical costs incurred have been as follows:

• Recent new construction (1988)	$151/sq. ft.
• Weatherization (approximate)	$0.50/sq. ft.
• Re-roofing - $40-$50/square	($.20 - $.50/sq. ft. floor area)
• Asbestos abatement (approximate)	$4/sq. ft.

The maintenance budget for 1991-1992 was $243,000 (about $.50/sq. ft.).

The last school building constructed in Blytheville was the West Junior High School, completed in 1988. In this case, even though not required by the code, the designer and the school district voluntarily decided to design the building to meet proposed seismic design requirements. The added cost (5%) was considered acceptable and was not raised as a public issue.

Seismic retrofit poses a more difficult problem. Retrofit of existing unreinforced masonry buildings could cost up to 30% of replacement costs. There is no seismic retrofit currently planned in Blytheville.

VI. FINANCIAL AND BUDGET ISSUES

The State of Arkansas does not contribute funds for local school construction or capital improvement. The State does contribute toward local school operation budgets, which in the case of Blytheville includes facilities maintenance. Thus, up to 50% of school maintenance is covered by State funds.

Capital funds for local school construction in Arkansas are raised by bond issues, which require school district voter approval. The maintenance budget, as part of operations, is approved by the School Board, and is funded by property taxes and State contributions.

It is very difficult for Blytheville to consider funding a major seismic retrofit of its existing school buildings. It is also considered unlikely that the State will provide funding as this is not a statewide problem. Incremental expenditure to increase seismic safety over time might be a feasible strategy for Blytheville if affordable techniques could be developed.

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

The potential liability of Blytheville Public Schools in the event of earthquake-caused damage or injury has not been considered.

To date, existing school buildings have not been analyzed for seismic vulnerability. There is no requirement that vulnerability of existing buildings be studied, and no requirement that existing buildings be upgraded. Inappropriate use of seismic vulnerability studies could create a panic response. At this point, a program of integrated incremental strengthening seems to be the only feasible means to reduce seismic vulnerability.

VIII. SUMMARY AND OBSERVATIONS

1. Blytheville Public Schools have an effective and efficient program of Facilities Planning and Maintenance appropriate to the scale of activity and local resources. The district has well maintained buildings and has taken initiative to pursue appropriate retrofit measures to maintain the serviceability of its facilities.

2. Earthquake risk in Blytheville has only recently been widely recognized. While seismic design is now required for new construction, there is currently no requirement for upgrading of existing construction.

3. Local officials are clearly concerned about the safety of their buildings and interested in finding economically feasible approaches to providing safe structures.

4. Due to limited local resources, a mandated program of strengthening would have to be accompanied with State or federal grants to pay for the program. A long-term plan for integrated, incremental, upgrading would seem to provide a feasible solution to this long-term problem.

ATTACHMENT E

SEATTLE CASE STUDY

November 2, 1993

I. DISTRICT INFORMATION

There are about 45,000 pupils attending 91 public schools occupying over 100 buildings in Seattle. They are owned and administered by Seattle Public Schools.

The average age of a Seattle school building is about 50 years. The oldest occupied buildings are pre-1900. The construction of schools has generally been uniform over the past 70 years, with a dip in the period 1940-60. Between 40% and 50% of the buildings are reportedly of unreinforced masonry load bearing construction. Enrollment in Seattle Public Schools has been declining over recent years, and there have been a number of school closures. This trend has reportedly ended, and student populations are projected to begin a moderate but steady increase over the next 20 years. By 2010, projections call for a school population of 56,600, an almost 30% increase over today's enrollment. Five-seven buildings were demolished in the past ten years.

The annual public school budget in Seattle is about $296 million. The average expenditure per pupil is a high $6,400. Seattle Public Schools is attempting to initiate a capital improvement program to the year 2000, which is discussed later.

Seattle Public Schools have been implementing seismic retrofit over the past 40 years, which is discussed later.

Seattle Public Schools has commercial property insurance which includes all risks including earthquake ($30 million limit with a 5% deductible) at a cost of $260,000 per year.

II. WHY THIS DISTRICT WAS SELECTED

Seattle was selected for two reasons:

- Exploratory discussions with Seattle Public Schools indicated that the district has for some time been implementing incremental seismic retrofit dovetailed ("woven") into other work, as hypothesized in this NSF project.

- Puget Sound is a region of recent repeated seismic activity, and it has been the focus of much attention under the National Earthquake Hazards Reduction Program (NEHRP).

III. SEISMIC AWARENESS AND POLICY

Seismic Experience

The Juan de Fuca plate, which is relatively small, is located off the coast of Washington, Oregon and Northern California. Its motions beneath the North American plate are the source of seismic events in the Pacific Northwest. The result is shallow earthquakes widely distributed over Washington, and deep earthquakes in the western parts of Washington and Oregon.

Large earthquakes are anticipated about every 35 years, although there is some disagreement. Earthquakes of magnitude 8 or greater are suggested by the geology, but none has occurred in the past 150 years. The interval time for a great earthquake appears to be several hundred years.

From 1982 to 1986, 78 earthquakes were reported felt in Washington. Few of these caused damage. Nineteen earthquakes over the past 150 years were large enough to cause structural damage. The major earthquakes occurred in 1949 near Olympia (magnitude 7.1) and in 1965 in the Seattle-Tacoma area (magnitude 6.9). These resulted in 15 deaths and caused more than $200 million in property damage (1984 dollars) including school damage.

Statewide Earthquake Awareness and Planning Efforts

There is a general level of awareness that there is a seismic hazard in the Puget Sound region. The levels of public and professional awareness (the latter already quite high) and interest were given a dramatic boost by the Loma Prieta earthquake. A conference entitled "Earthquake in Washington: Are We Ready?", co-chaired by the Governor and both U.S. senators, attracted about 1,400 attendees on February 14, 1990. A State Division of Emergency Management seminar on ATC-20 attracted over 500 people on January 19, 1990. This dramatic increase in awareness has not translated into political action at the state level.

In 1955 the legislature passed statewide Earthquake Resistance Standards for "hospitals, schools..., buildings for the public assembly..., and all public-owned structures...". A State Seismic Safety Council was created in 1985, was funded for one year and was dissolved. The Council published a report in 1986 containing a series of legislative and administrative policy recommendations which have been proposed since then with little success. One recommendation, a School Seismic Safety Act, has repeatedly failed to pass the legislature. Two bills were introduced in the 1990 regular session, one calling for inspection, reporting, closing and remedial work for all schools, as well as the establishment of an earthquake emergency procedure system, and the other more modest in its scope. Both bills failed to pass.

The State Superintendent of Public Instruction (SPI), an independently elected cabinet post in the state of Washington, and the State Board of Education are responsible for allocating state funds, including capital improvement funds, to local school districts (see further discussion later). The SPI has had an ongoing interest in earthquakes. A Non-Structural Earthquake Hazards Manual, which includes chimneys, exterior ornamentation, masonry wall anchorage and parapets, was issued in July 1989.

Following the Loma Prieta earthquake (October 1989) the SPI took a more active interest in seismic issues. The Washington State School Architect made tentative estimates of the number of school children in buildings with seismic risk at 200,000. This figure was publicized by the SPI and was widely distributed by the press. As a result, a survey was initiated at the SPI district offices to get information on unreinforced masonry schools. By early 1990 about 1,140 of statewide total of over 2,100 buildings (100 million square feet) were covered by the survey. Between 350 and 400 buildings containing about 155,000 pupils were identified as unreinforced masonry. Ninety-three buildings were reported as having been seismically strengthened.

The costs of modernization and seismic strengthening of pre-1965 schools throughout the state has been estimated at $1.1 billion. There has been some discussion at the legislature to earmark more state funds for modernization, but suggestions that seismic strengthening be given priority over program modernization have not been well received.

Emergency Management

Emergency management and planning, both at the state level and in Seattle, are not very robust activities and are carried out at a relatively low level of government.

Cooperation is beginning to emerge between Seattle's emergency management planners and Seattle Public School's risk management activities, but we were unable to get detailed planning information on specific roles of schools in case of an earthquake.

In 1983 Seattle Public Schools was funded under the NEHRP to work with five schools in developing an earthquake education program. Some individual schools are still following up on this, and while the PTA is reportedly supportive, there has been little continuity in this area.

The Seattle Public Schools risk manager reported an active earthquake response program, concentrating primarily on the availability of first aid kits.

Seattle Public Schools maintains close liaison with the community at large. The Chamber of Commerce is involved in the Levy bond issues every two years (see below). The Alliance for Education is the formal link between Seattle Public Schools and the business community. Nevertheless, Seattle Public Schools senior personnel do not feel that their seismic mitigation plan has any direct influence on other public or community programs in Seattle.

IV. REGULATORY BACKGROUND (CONTEXT)

State - As stated above, the Washington state legislature passed statewide Earthquake Resistance Standards in 1955 for "hospitals, schools..., buildings for the public assembly..., and all public-owned structures...". Additional legislation adopted the Uniform Building Code (UBC) statewide, effective in 1978. Local jurisdictions may adopt more stringent requirements. All buildings, including state-owned buildings, are subject to local code enforcement in Washington.

The State Building Code Council (BCC) was created in 1975 to administer the statewide accessibility requirements, and in 1979/80 it was given the code adoption authority. Its current function is mainly to encourage statewide code uniformity. It is funded by a $4.50 surcharge on all building permits in the state.

Seattle - The city of Seattle has code enforcement jurisdiction over Seattle Public Schools. It currently uses the 1991 UBC, including Seismic Zone 3 requirements in new construction.

In the case of existing buildings, seismic retrofit is required in buildings undergoing "extensive rehabilitation", defined in the Seattle Building Code. The seismic requirements of the Uniform Code for Building Conservation (UCBC) are used as an option in such cases, but it is not required. This practice has been in effect for almost 20 years, and 20-30 unreinforced masonry buildings per year have reportedly been strengthened under it. Over one half of the major buildings in Seattle have reportedly been strengthened, and there remain an estimated 500 unstrengthened buildings. The Seattle Public Schools seismic retrofit work (see later) has been primarily voluntary.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

Following is a chronology of Seattle Public Schools capital improvements and maintenance, as related to seismic issues:

1949

Ten schools were reportedly damaged in the 1949 earthquake and were later demolished. Two of these were in Seattle. Other Seattle schools were damaged (facades, cornices and chimneys). There were no related injuries because schools were not in session when the earthquake occurred.

In addition to the demolitions, the damage triggered some seismic rehab work in the early 1950s. This reportedly consisted of tiebacks of masonry facade elements to the wood structures.

The earthquake also led to a change in Seattle's parapet ordinance.

1965

The 1965 earthquake triggered code changes in Seattle, but did not result in seismic work on Seattle schools for at least ten years. (This is inconsistent with the references to some gable and other repairs following 1965, which are found in the 1977 Seismic Survey of 22 Seattle Schools discussed below.) Little retrofit work was done in general in Seattle schools between 1960 and 1970.

1977-1979

Seattle school district planning efforts in the late 1970s and into the early 1980s were related to school closings due to declining enrollment and excess space. However, decisions related to the closing and/or demolition of older schools must be taken in the context of a strong landmark ordinance, and the fact that many older schools are designated as historic landmarks.

A Facilities Utilization Study reportedly identified Hawthorne Elementary and four other schools as "imminent hazards", and led to the Seismic Survey of 22 Seattle Schools, dated November 30, 1977. Three engineering firms conducted "limited observations of structural elements and a brief design review" of buildings which for the most part consisted of load bearing masonry walls and wood floors and roofs. The engineers recommended three levels of work:

- Imminent hazards consisting mostly of parapets, gables, chimneys, and loose or poorly anchored masonry.
- Limited floor and roof ties, diaphragm reinforcement, and added shear walls.
- "Present code requirements".

Cost estimates were also included.

This was followed by the Seismic Survey of 10 Schools and Chimneys at 53 Schools, dated September 6, 1978. (This report referred to "seismic corrections to 19 schools, currently concluding"----presumably 19 of the 22 previously surveyed.) The 10 schools were inspected, consisting of load bearing masonry walls and reinforced concrete floors (9 schools) or wood floors (one school). Information on the chimneys at 53 schools was obtained by a questionnaire. The engineers recommended work to remove the imminent hazards. Cost estimates were included ($460,000 for the schools, over $40,000 for the chimneys).

This in turn was followed by Seismic Inspections, 87 Schools, dated August 10, 1979. The survey was carried out by a District Building Inspector and a Brick Mason of the Maintenance Section. The survey found that 50 schools required no seismic work, 12

44

required "some attention to skylights only", and 25 have problems which "may be considered as 'grave risk hazards'." For the latter work items were identified, but costs were not estimated. The report concluded that "with adequate funding, specifications can be prepared and work completed by the start of the 1980-81 school year."

With these three surveys the imminent seismic hazards in all Seattle schools were identified.

1983

A long range plan was approved by the Board in 1981, which covered the period 1981-1990. This included a two-tiered approach to capital improvements:

- Repairs and major maintenance, funded by Capital Levy Bonds (see below).
- Replacement or modernization of hazardous buildings, funded by Capital Improvement Bonds (CIP-1), which started in 1984.

In carrying out the plan, the District commissioned CMB/KIM Architects & Engineers to carry out a comprehensive survey of all Seattle schools. The study was initiated in December of 1982. A preliminary report consisting of three volumes and entitled Comprehensive Survey of Educational Facilities, Seattle School District No.1 was published on April 8, 1983. The study consisted of two basic parts:

- An inventory and categorization of deficiencies.
- A seismic analysis of every building.

The deficiency inventory was based on a field inspection of each site by a minimum of five professionals, including an architect, a structural engineer, a mechanical and electrical engineer, and a certified roofing inspector. Approximately 50 man-hours were spent at each site. Approximately 6,000 deficiencies were documented at 101 sites. Deficiencies were prioritized in terms of levels of risk, impact of non-action and related by level of condition. The useful life of each recorded deficiency was established. Hazardous conditions were processed under special procedures, and received immediate attention by the District.

The seismic analysis for each facility consisted of seven parts:

- Field inspection and evaluation.
- Immediate reporting of major deficiencies.
- Computation of ratings in terms of structural and nonstructural quality.
- Establishment of probabilities of occurrence for major earthquakes.

- Determination of possible site-dependent amplification due to poor soil conditions.
- Computation of risks (in terms of damage and casualties).
- Comparisons with other commonly accepted risks.

The analysis utilized a rating system ranging from 0 to 100, wherein structural components of varying weights could receive up to 67 points and architectural components of varying weights could receive up to 33 points. Deficiencies in design quality and component condition could further reduce the ratings.

The analysis used damage algorithms partly based on work by Wiggins and Moran (1971) and Whitman et al (1975), and summarized by Lee and Collins (1977).

The engineers concluded that:

> *Based on this survey, the majority of facilities exceed an "ordinary" level of acceptable risk. These structures should be strengthened or retired as soon as monetary resources permit it. The methodology taken in this evaluation is directed towards establishing procedures and priorities to reduce the risks to acceptable levels.*

The CMB/KIM preliminary report called for additional value engineering and life cycle cost analyses. While these analyses were not formally carried out, it is clear that the CMB/KIM study provided the base for the major maintenance and repairs done under the Capital Levy Program (CLP) in the 1980s (reportedly, structural improvements, with a cap of $150,000 on seismic work, were undertaken at 20 schools under the CLP program), and the Capital Improvement Program (CIP-I).

The CIP-I, approved by the voters in 1984, resulted in the modernization or replacement of 14 elementary schools and one high school between 1986 and 1991, at a cost of about $140 million (of which about $40 million were State funds). The program utilized data from the CMB/KIM report, supplemented by information developed by each project's construction manager. The seismic improvements included in each project were based on proposals by each architect-engineer team who had been provided with the CMB/KIM data. These proposals were then negotiated with the Seattle building department, with the negotiations forming the basis for each building permit. Each school was individually negotiated.

1991

Since 1982 the District has reportedly been refining its approach to seismic rehabilitation under both the Capital Levy Program and the Capital Improvement Program. At the same time, significant changes occurred in the seismic requirements of the building code, reflecting a greater understanding of building performance in an earthquake. In order to keep pace with these changes, Seattle Public Schools undertook two related engineering studies which produced two 1991 reports referred to as the TRA and the Dodd Pacific reports.

The first study, entitled Structural Evaluation of Seattle Public Schools was produced by TRA Architecture Engineering Planning Interiors of Seattle, and published in early 1991. This was a structural evaluation of the seismic resistance of all Seattle schools constructed before 1968, and was viewed as an "augmentative update" of the seismic portion of the 1982 CMB/KIM report. The goal of the study was

> "...to establish a minimum standard for seismic upgrade of all existing schools and to rate the schools relative to that standard."

TRA used the "Rapid Analysis Procedure" of ATC-14, Evaluating the Seismic Resistance of Existing Buildings, first published in 1987, and the ABK methodology for unreinforced masonry buildings prepared under a grant from the National Science Foundation in 1984. The procedure is based on a survey of drawings and documents, and does not require field inspection. The ATC-14 methodology rates the structural capacity of the major seismic load resisting components, and compares them to a defined standard. A numerical rating allows the ranking of buildings. A rating of 100 represents a building whose allowable shear stress and required shear stress are equal. (In order to relate the ATC-14 standard to other known standards, TRA state that an equivalent new school designed to meet the 1988 Uniform Building Code will rank above a rating of 165.) TRA applied an importance factor of 1.25 to the analysis of Seattle schools (i.e., a rating of 100 meets 125% of the ATC-14 minimum standard). TRA further point out that

> "A rating of 100 or greater does not necessarily indicate that no remedial work will be needed. What it does indicate is that the building contains adequate structural elements to meet the standard. Other structural issues that are not directly addressed in the study are the adequacy of internal structural connections and non-structural elements."

The ratings for Seattle schools ranged from 20 to 750, for 166 separately identified buildings (i.e., several buildings per school). Eighty-six buildings (50 schools) rated below 100. TRA tabulated the CMB/KIM seismic ratings together with the ATC-14 ratings. There does not appear to be a direct correlation between the two rating methods.

The 50 schools with ratings below 100 were subjected to further structural analysis by Dodd Pacific Engineering, Inc. of Seattle and San Francisco. The analysis was based on a review of drawings, and without site visits. Dodd Pacific utilized the results of their analysis to prepare general recommendations for seismic upgrades of the major seismic load resisting components. In addition they prepared recommendations for the repair of major nonstructural deficiencies such as unreinforced masonry chimneys and parapets in each building. Each building was assigned a priority ranking from 1 to 7 (1 being best) to assist the non-technical users of the study. Finally, preliminary construction cost estimates to implement the recommended seismic upgrades were prepared for each building. The results of the analysis were published in early 1991 in a document entitled Abbreviated ATC-14 and ABK Seismic Evaluations, and Preliminary Construction Cost Estimates.

1992

In January and February 1992 Seattle Public Schools published two related reports designated "Creating The Space To Learn ---- Superintendent's Preliminary Recommendations." The first is a "Proposed Facilities Master Plan 1992 to 2010", and the second is a "Proposed Phase II Capital Improvement Program". Following extensive public review, these documents were revised and adopted by the Board of Directors, and published on July 15, 1992 as "Superintendent's Final Recommendations ---- 2010 Facilities Master Plan and Capital Improvement Program Phase II."

The plan states that "the years of enrollment decline and school closures appear to be over...By 2010, close to 57,000...students will be attending Seattle Public Schools. This number represents an almost 30% jump from today's present enrollment..." It continues:

> "While educators, students and parents wrestle with the educational challenges of the next century, the facilities that house and support our educational programs will also have to be transformed. More than a third of Seattle schools are already 60 years or older. Many are in poor condition and have outdated electrical, heating and ventilating systems. **Forty percent still need significant work to improve resistance to earthquakes**. Many lack the space and technology needed to educate today's students to be successful in tomorrow's competitive world." (Emphasis added)

The Board adopted 11 facilities goals for the District, of which two are especially relevant to this study. Goal 3 states:

> "Assure that buildings meet health and safety standards with regard to seismic, fire, lighting, etc."

Goal 8 states:

> "Provide safe, secure and efficient buildings from which essential and vital operations can be continued if a disaster occurs."

The planned Capital Improvement Program Phase II (CIP-II), covering the period 1992-2000, includes the modernization, preservation or replacement of 25 elementary schools, two middle schools, five high schools and six alternative/special schools. The estimated cost of CIP-II is $795 million. $695 million would be obtained through a 15-year bond measure (rejected by the voters twice, in September and November 1992). Approximately $100 million would be supplemented from other sources such as interest earnings, state matching funds and possible future development impact fees. Capital Levy funds would continue to be made available for schools not included in CIP-II, but in need of seismic and other building improvements.

The Board adopted six criteria for CIP-II selection and order of projects. In order of importance (percentages provided by Board staff), these are:

1. Completion of projects left over from CIP-I.
2. **Seismic conditions** (30%).
3. Conditions of structures' physical systems (25%).
4. Adequacy for educational uses (20%).
5. Need for increased capacity to meet projected student population and desegregation goals (15%).
6. Age (10%).

(Emphasis added)

The rating system of seismic condition was based on the ATC-14 rating (TRA), the Dodd Pacific priority ranking, and the seismic upgrade cost estimates (Dodd Pacific amended).

Following the defeat of the $695 million bond at the polls in 1992, which was reportedly attributable to a lack of project specificity and lack of support of the preservation community, CIP-II was scaled back by pushing its end date from the year 2000 to 2005. An initial bond issue of $339 million has been authorized by the School Board. CIP-II project criteria have not changed.

A Seismic Action Plan was developed by District staff in parallel with the 2010 Facility Master Plan and CIP-II. The Seismic Action Plan is viewed as the culmination of all the previous structural evaluations and studies (reported above). Scheduling of seismic work in the plan is based on the "worst first" concept, i.e., schools with lower seismic ratings are to be upgraded first. Capital Levy Program (CLP) work is projected for all 50 schools in the Dodd Pacific study. The Seismic Action Plan makes the following assumptions regarding the relationship of work under CLP and CIP-II. (It should be noted that CLP and CIP projects are administered separately within the Seattle Public Schools organizational structure):

- CLP upgrades on CIP-II schools will be completed only if there is a two-year interval between CIP-II construction and CLP work.

- CLP upgrades on CIP-II schools will be limited to a maximum dollar amount of $200,000 per year for all CLP work.

- CLP upgrades on non CIP-II schools will be included with other CLP renovations.

VI. FINANCIAL AND BUDGET ISSUES

State Role

The State of Washington is heavily involved in financing local school districts. The state matches capital improvement funds raised in local bond issues in a ratio ranging from 20% to 90%, based on district income and integration issues. (Seattle receives a 20% match from the state.) These funds can be used for new construction and modernization.

The State Superintendent of Public Instruction (SPI) reviews local capital improvement projects. This is not a detailed review ("ala California"), and it does not duplicate local building code review. SPI requires local code official approval of all projects, and assumes that this leads to code compliance. There is some question as to the validity of this assumption in the case of modernization, and particularly in cases involving seismic rehabilitation.

Until 1992 SPI used a five category weighting system for setting priorities in allocating its capital improvement matching funds. This system tended to discourage modernization. In February 1992, in response to a directive by the Legislature, a new system based on a cumulative point score was established.

A study was conducted to develop the new system. The study was comprehensive, and included educational, societal and environmental factors. As part of the study, all school districts were surveyed regarding the nature of their facilities and their estimated needs for the future. Over one-half of the districts (50.3%) covering 60.3% of total enrollment responded. In rating the physical condition of their schools, superintendents indicated that one-fourth were in "excellent" condition and that 35% were in "good" condition needing only minor repair. However, nearly 40% of schools were estimated to be in "poor" or "very poor" condition, requiring major repair or replacement. Districts were asked whether their schools met current seismic and asbestos codes and whether they met EPA radon guidelines. 38% of schools in the survey did not meet the seismic code, 19% did not meet asbestos codes and 16% were said not to meet radon guidelines.

The resulting scoring system allocates a possible 85 points for new construction projects and 70 points for modernization. Of the latter up to 20 points are allowed for health and safety deficiencies, of which up to 2 points for "failing to meet seismic codes" and up to 2 points for presence of asbestos.

In summary, seismic rehabilitation does not weigh much in the State's priorities for matching local capital improvement funds. This is despite the recent SPI survey of statewide seismic deficiencies discussed earlier.

Traditionally the source of funds for the SPI was "Timber funds". These have declined in recent years, and have already been supplemented by general funds. It is possible that this will lead to greater involvement of the Legislature in school capital improvements, an area heretofore almost exclusively in the hands of the State Board of Education.

Seattle Public Schools

Seattle Public Schools, like other school districts in Washington, has two ways of raising funds for building improvements:

- Levy bonds
- Capital improvement bonds

Levy bonds are repaid in two years, and can be issued every two years. The proceeds can be used for reroofing, mechanical retrofit etc. ("items that are beyond maintenance but less than full rehab"). The state does not match any levy bond funds, and state approval is not required. Seattle Public Schools has used levy bonds to fund some seismic retrofit work, under the Capital Levy Program (CLP).

Capital improvement bonds raise funds for modernization and new construction. The state provides a 20-90% match, and the programs (which may or may not identify specific schools) are subject to state review and approval. Seattle Public Schools has received 20% matches from the state.

Projected Capital Levy rates (per $1,000 of assessed valuation) are about $1.38 in 1992, and $0.21 per year after 1995. Prior to the voters' rejection of the $695 million capital improvement bond (CIP-II) in November 1992, the total projected levy rates through the year 2007, assuming a CIP-II 15-year bond authorization of $695 million, and including the Maintenance and Operation Levy, were $3.38 starting in 1993.

In September 1993 the School Board subsequently authorized placing a $339 million bond issue on the February 1994 ballot.

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

Incremental seismic strengthening has been practiced by Seattle Public Schools since the early 1950s, and it does not seem to present any legal problems. The Risk Manager felt that seismic mitigation planning, which can include incremental strengthening, is the start of a defense against a real risk of liability in case of an earthquake.

VIII. SUMMARY AND OBSERVATIONS

Lessons Learned

1. While the State of Washington is a contributor of school capital funds in the state and thus could become a strong force for school seismic retrofit, it has not done so. History has demonstrated that the significance of school seismic retrofit in Seattle has been self-generated and self-sustaining by the School District.

2. Seismic response and mitigation planning at both the state and local levels are not currently activities which support seismic retrofit of schools.

3. Seattle Public School's recent seismic retrofit programs, under both the CLP and the CIPs, is based on a detailed inventory of the buildings and their components, detailed seismic analyses, and detailed cost estimates. They demonstrate how a data base is essential to the support of long range strategic planning.

4. The defeat of CIP-II at the polls may demonstrate that a school facilities long range capital improvement program which places more weight on seismic vulnerability than on any other single parameter is not politically acceptable, even in Seismic Zone 3. On the other hand, Seattle's history of successful incremental seismic retrofit ("weaving in") seems to support the hypothesis of this project.

Changes to Improve Seismic Retrofit

The defeat of the CIP-II bond issue should not be seen as the rejection of the Capital Improvement Program. Alternative financing and scheduling should be explored.

What Can Be Shared with Other Districts

There is one basic lesson which Seattle can share:

1. Seattle Public Schools is well along the road of seismic retrofit of its buildings, a road that most other school districts are only beginning to chart. Seattle's chronology, briefly summarized above, should be examined in detail for parallels and applications elsewhere.

APPENDIX A

LIST OF INTERVIEWEES

Seattle Public Schools - District Facilities Center:
    John Jacobson, Acting Director, Facilities Development & Construction
    Martin Castaneda, Capital Levy Projects
    Douglas Hayner, Capital Improvement Program
    Douglas McCudden, Architect/Project Manager
    John Vaccari, Facility Planner
    Nancy Burton, Facility Planner
    Kathy Renike, Risk Manager
Carole Martens, State Liaison

Carter Bagg, Washington State School Architect
Harvey Childs, Washington State Budget Office
Tom Kinsman, Seattle Department of Construction and Land Use
Eric Pedigrew, Seattle Emergency Management
Chrisine Jonientz-Trisler, Earthquake Program Manager, FEMA Region X
Linda Noson, Ratti, Swenson, Perbix & Clark, Seattle

ATTACHMENT F

PORTLAND CASE STUDY

April 8, 1994

I. DISTRICT INFORMATION

There are 56,282 pupils attending 104 public schools occupying 126 buildings in Portland. They are owned and administered by Portland Public Schools.

The average age of a Portland school building is about 65 years. The oldest occupied buildings are pre-1900. Ninety-eight percent of the buildings are over 20 years old, and 43% were constructed between 1940 and 1960. While fifty percent of the buildings were initially reported to be of unreinforced masonry load bearing construction, more recent reviews of archival plans have revised this estimate to 10-20%. (Apparently many older buildings were determined to be reinforced concrete frames with masonry veneer.) Enrollment in Portland Public Schools is expanding. Six buildings were abandoned or demolished in the past ten years.

The annual public school budget in Portland is over $360 million. The average expenditure per pupil is about $6,400. Portland Public Schools is in the midst of implementing a five-year capital improvement plan, which is discussed later.

The Superintendent of Portland Public Schools, whose last assignment was on Long Island, N.Y., has only recently been appointed to the position. He emphasizes the civic mindedness of Portland, the sense of public involvement, and the quality of public service. He believes there are no divisions between major sectors of Portland society on long range issues and goals, and that it is easy to achieve consensus in the context of long range planning.

Even though six schools were abandoned or demolished in the past ten years, the Superintendent does not believe Portland Public Schools will be demolishing more buildings. One of his objectives is to institutionalize long range planning, and he thinks that incremental seismic improvements can make sense in this context.

Portland Public Schools has commercial property insurance which includes fire insurance ($750,000 deductible per occurrence), and, until recently, no earthquake coverage. Prior to the March 25, 1993 northwest Oregon earthquake there was a proposal before the Board to purchase $100 million of earthquake insurance at a cost of $45,000, with $1,000,000 deductible. This proposal was subsequently reduced as a result of available capacity of the insurer. Currently Portland Public Schools has $25 million of earthquake insurance at a cost of $38,000, with one million deductible.

Portland Public Schools self insures for liability.

II. WHY PORTLAND WAS SELECTED

Portland was selected for two reasons:

- It is nationally recognized in school circles for its sophisticated approach to facility maintenance and capital planning and programs.
- It is located in a region where recent scientific evidence is pointing to a higher level of seismicity than previously recognized, and where the building code's seismic zonation has been recently upgraded from 2B to 3.

III. SEISMIC AWARENESS AND POLICY

Seismic Experience

Recent geologic and seismologic studies have significantly modified the understanding of seismic hazard in the Pacific Northwest. These studies indicate that the region may be subjected to a significant level of seismic hazard compared to what has been experienced in historic times (150 years in the Pacific Northwest).

Prior to the March 25, 1993 northwest Oregon earthquake, estimated magnitude 5.5, the Portland metropolitan area had experienced only two damaging earthquakes in recent times: a magnitude 5+ in October 1877, and a magnitude 5.1 on November 5, 1962. It is now understood that there are three potential sources of strong earthquake ground shaking in the Pacific Northwest:

1. The possible occurrence of a great earthquake (magnitude >8) occurring along the Cascadia subduction zone.
2. A relatively deep intraplate event occurring within the subducted Juan de Fuca plate, similar to the 1949 Olympia (magnitude 7.1) and the 1965 Seattle-Tacoma (magnitude 6.5) earthquakes.
3. A shallow crustal earthquake in the North American plate such as the 1872 North Cascades (magnitude 7.3) and the 1877 and 1962 Portland earthquakes.

Scientific evidence on the Oregon and Washington coast now indicate that subduction events have occurred in the past at a recurrence interval of 400-550 years. The research further suggests that the last major earthquake (magnitude >8) occurred about 300 years ago. Based on this, scientists estimate that there is a 20% probability that a large subduction zone earthquake can occur in the next 50 years in the Pacific Northwest.

It is this information which underlies current seismic policy and planning in Oregon.

Current Statewide Earthquake Planning Efforts

Several statewide earthquake planning efforts have been initiated in the past several years.

- Oregon Seismic Safety Policy Advisory Commission (OSSPAC)

  The commission, originally convened by executive order of the governor, was established by the legislature in 1991 (Senate Bill 96). The mission of OSSPAC is to reduce exposure to earthquake hazards in Oregon by:

  1. Developing and influencing policy at federal, state and local levels.
  2. Facilitating improved public understanding and encouraging identification of risk.
  3. Supporting research and special studies.
  4. Implementing appropriate mitigation.
  5. Preparing for response and recovery.

  In addition to working with the Metropolitan Service District (Metro) in its earthquake planning project (see below), OSSPAC is addressing building code requirements, land use and local emergency response planning, and recently put on a two-day workshop on seismic retrofit. OSSPAC's chairman is Roger McGarrigle, who represents the Structural Engineers Association of Oregon.

- Department of Geology and Mineral Industries (DOGAMI)

  The 1989 Session of the Oregon Legislature designated DOGAMI as the lead agency for earthquake hazard research in Oregon (Senate Bill 955). DOGAMI has established a goal to be able to predict earthquake effects in the state by 1995. It is producing earthquake hazard maps for the major urban areas in western Oregon. These will show relative liquefaction potential, relative amplification potential and relative earthquake-induced landslide potential.

- Universities

  Oregon State University, University of Oregon and Portland State University are continuing research efforts directed at a better understanding of seismic issues in Oregon.

- Oregon Department of Transportation (ODOT)

  ODOT is currently conducting a study to assess structural stability of major bridges in the state, which will provide data regarding the economics and engineering design needs for seismic retrofit of highway critical structures.

- Utilities

  The major utilities in western Oregon have initiated discussions about the need to assess seismic safety of their critical structures and networks.

- Regional Disaster Response Plan

  Local emergency planners have initiated discussions on developing a Regional Disaster Response Plan with an emphasis on earthquake response. To date these discussions have reportedly been slow, due to lack of staff, competition for funding and a feeling of lack of political support.

- Building Code

  The Uniform Building Code is used in Oregon. According to the Seismic Zone Map in the 1991 Uniform Building Code, the entire state of Oregon is located in Zone 2B. Oregon has recently changed the map by amendment so that western Oregon (west of the Cascades) is now Zone 3.

Earthquake Awareness

Earthquake awareness in Oregon is clearly in a state of change, and was given a boost by the March 25, 1993 earthquake. Prior to the latter event the Earthquake Program Coordinator at Oregon Emergency Management estimated that 75% of the public had heard about the earthquake hazard, but that much fewer believed in it. While state and local government agencies were generally aware of the threat, the Earthquake Program Coordinator suggested that only a handful of State legislators took it seriously. The level of awareness in the business community was said to be lower than in the government. The 1993 earthquake has changed all that.

This general picture was confirmed by the Emergency Coordinator of the City of Portland. He stated that five years ago the city fathers would have laughed at the mention of earthquake hazard. Today, even before the 1993 earthquake, it is recognized by government as a question of "not if, but when?" Earthquake awareness in Portland reportedly started with the public schools, when the city Office of Emergency Management provided the principals with one hour of earthquake training. However, there is no city budget for a general awareness program except for Earthquake Week.

The media, reportedly even before the 1993 earthquake, have done an excellent job of providing earthquake information to the citizens of the region. In the second half of 1991 their efforts in providing an understanding of the importance of public outreach on seismic issues to emergency managers and scientists has been significant.

In terms of awareness of the seismic risk within Portland Public Schools, the Superintendent, as a newcomer to the Northwest, could only state prior to the recent earthquake that he had heard about the risk. However, the Chief Financial Officer reported a growth in awareness in recent years, and inadequate preparedness to meet it.

Prior to the March 25, 1993 earthquake the Risk Manager of Portland Public Schools characterized the seismic risk as being "200-300 years from now", and as being unquantifiable. However, he believes the district has a liability exposure in case of an earthquake. He would therefore support activities of earthquake "preparedness", which would serve as a defense against potential liability actions.

Emergency Management

State - Oregon Emergency Management is in the Executive Department. There is a designated Earthquake Program Coordinator, whose main effort is concentrated on raising earthquake awareness. The State's emergency plan does not yet include a written earthquake component, although one is reportedly to be developed. The role of public schools in the State's emergency plan is generic for all emergencies, with detailed planning, if any, left to the local jurisdictions:

- Temporary protection of children till they can be released to someone's care.
- Mass care shelter.

It is unclear whether the office of the State Superintendent of Public Instruction is officially cognizant of this role, or that it is somehow reflected in specific plans.

While we have no information on whether the State requires local jurisdictions to prepare emergency plans, it has not issued any guidance to local jurisdiction on earthquake emergency planning.

A statewide earthquake exercise was conducted in early 1991. It involved playing out an earthquake scenario at the State Emergency Operations Center. Portland Public Schools were involved in the exercise.

Earthquake drills in schools are required by State legislation (Senate Bill 66).

Metro - The Metropolitan Service District, which is a regional government planning body in the Portland metropolitan area, adopted an Emergency Management Work Plan on

Earthquake Preparedness in November 1991. Its purpose in FY 1991-92 was to initiate a regional earthquake planning effort with a focus on mitigation. The plan consisted of several parts:

- Working with DOGAMI to develop a seismic hazard database utilizing Metro's Regional Land Information System (RLIS).
- Assessing seismic risks at Metro facilities.
- Developing a regional seismic hazards need assessment.
- Researching program funding alternatives.
- Establishing Metro's role in regional emergency management.
- Strengthening the roles of local officials, local emergency planners and local land use planners in mitigating the impacts of an earthquake.

Some federal support from FEMA was obtained, and in August 1992 Metro undertook the Metro/DOGAMI Earthquake Scenario Pilot Project. The project initially involved a study area of about 60 blocks within the City of Portland. The area is bisected by the Willamette River, and includes about 180 buildings, rail lines, overpasses, port structures and lifeline systems. It also includes one public school. The project has subsequently been expanded to include the entire Portland Quadrangle (USGS), using data from the building department (in lieu of field data). The results of the study will be used to facilitate region-wide discussion of seismic hazards problems and how to deal with them cooperatively, and support the development of the regional emergency managers' earthquake planning projects.

Results of the study have already been used to support a federal grant request for a regional earthquake vulnerability study, which has been funded.

Portland - The Portland emergency plan assigns post-disaster functions to different bureaus. It is not hazard-specific, though it is recently placing more focus on earthquake disaster. An earthquake regional plan is currently being developed. (It is unclear if this plan is being developed by Metro or by Portland.) It will be based on the identification of geographic islands of isolation in case of an earthquake. Within each such island two facilities will be identified: one for response coordination (probably a fire station) and one for public shelter (probably a school). These facilities will undergo seismic analysis. The Office of Emergency Management has reportedly requested the Bureau of Buildings to carry out the analysis. The latter has indicated that it would contract out the analysis work. In addition, the Office of Emergency Management has identified critical public facilities in Portland, and has recommended that seismic analysis be undertaken. This has not yet been done.

An earthquake exercise involving 4,000 people was conducted in 1990, but the schools were not included. On the other hand, the risk manager at Portland Public Schools reported that they had participated in a regional earthquake drill even prior to the passage of Senate Bill 66. Portland Public Schools will participate in a regional earthquake drill planned for the Spring of 1994.

Portland Public Schools - The Director of the Physical Plant Division is also the Emergency Manager in Portland Public Schools. So far, most emergency management effort has gone into a program to upgrade life safety (i.e., egress) in the schools, in which the Portland Bureau of Buildings and Fire Prevention Bureau are involved. The program involves negotiated incremental improvements in two-year increments. So far 14 buildings have been upgraded, at a cost of $1.5 million. Sixty-six buildings remain with some life safety deficiencies.

The Director of the Physical Plant Division is Portland Public Schools' representative on the Technical Advisory Council established by the Portland Office of Emergency Management, which meets periodically on both Portland's and Metro's emergency planning activities. However, Portland Public Schools does not seem to be a central player in either activity.

The Superintendent has issued a directive to implement Senate Bill 66 (earthquake drills), and this will result in an updating of the Portland Public Schools Emergency Handbook which will explicitly deal with earthquakes. Meanwhile Portland Public Schools reportedly leads the state in earthquake drills, probably as a result of the training provided by the Office of Emergency Management to the school principals. Thirty minutes per month are devoted to this activity, but it reportedly does not generate the classroom enthusiasm that it should.

Some seismic analysis of Portland schools was reportedly carried out in the 1960s, but it does not appear to have led to any seismic rehab work. While seismic analysis was being planned in the context of ongoing capital improvement planning (see below), it was given added impetus by the March 25, 1993 earthquake, in which several Portland schools were slightly damaged.

IV. REGULATORY BACKGROUND (CONTEXT)

State - In Oregon the State promulgates the building code, and enforces it in those jurisdictions (cities and counties) which opt not to enforce the code. The State is also responsible for the elevator and boiler codes. Finally, the State tests and certifies local building officials, for which it collects a 5% surcharge on all permit fees.

The building code promulgated by the State is the Uniform Building Code (UBC). They have recently adopted the 1991 edition, including a change to place western Oregon in Seismic Zone 3. Some owners in Portland were reportedly building to Zone 3 requirements voluntarily even before the change.

Portland - The city of Portland has code enforcement jurisdiction over Portland Public Schools.

In enforcing the seismic provisions of the code, the City of Portland Bureau of Buildings evaluates the plans and reviews the calculations. In the case of a change of use in an existing building the Bureau of Buildings requires compliance with the code requirements for new construction, and when this is impractical they require an evaluation using a force analysis per the current code, and try to achieve "equivalent life safety". The case is then referred to the Structural Advisory Committee which makes a recommendation to the Bureau of Buildings. Unreinforced masonry walls are accepted for shear on the basis of tests.

In the case of a rehabilitation of an existing building the Bureau of Buildings "try to persuade the owner to hire an engineer to perform a seismic evaluation of the building." They have recently started using the seismic provisions of the Uniform Code for Building Conservation (UCBC) as a guideline in dealing with several buildings.

Chapter 24.55 of the Code of the City of Portland, Abatement of Unsafe, Abandoned and Dangerous Buildings (the "Hazardous Building Code"), is used in Portland as a tool for achieving, among other things, incremental improvements in existing buildings. The objective is to develop a program which leads to investment in existing buildings as a function of risk, rather than having such investment governed by arbitrary code triggers. The approach reportedly takes the economics of the situation into account by phasing the upgrade work. This is accomplished by means of a formal agreement of phased improvements making use of a series of renewable Temporary Certificates of Occupancy. The method has been used to accomplish a variety of life safety, accessibility and seismic improvements in Portland buildings. (We have obtained an example of an Agreement signed in January 1990 to achieve seismic strengthening of an unreinforced masonry building in four phases over a two-year period.) The Bureau of Buildings has entered into this type of agreement with Portland Public Schools to address life safety and accessibility issues, but it has not so far addressed seismic issues in schools.

One of the main issues in adopting the Zone 3 code change in Portland was that Chapter 24.55 includes a definition of "dangerous structure" as the lack of capacity to resist a minimum percentage of the forces defined in the building code. By this definition most buildings built to Zone 2B requirements are "dangerous" in Zone 3.

Following the March 25, 1993 northwest Oregon earthquake several draft proposals for seismic regulations for existing buildings have been circulated. A Seismic Task Force is reportedly about to be named to develop such regulations.

Finally, the Bureau of Fire, Rescue and Emergency Services has reportedly completed a seismic survey of Portland fire stations and other critical structures (at a cost of $30,000), and the Bureau of Buildings has recently completed a survey (employing students) of 3,000 unreinforced masonry buildings, most of them located in downtown Portland.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

General

In 1976 Portland Public Schools undertook the task of reducing a deferred maintenance backlog that had grown to significant proportion. (In 1984 deferred maintenance was estimated at $200 million.) Special Maintenance and Renovation Funds (065, 067 and 068) were established to address the most critical maintenance deficiencies along with considerable expansion and remodeling.

Since 1983 they have spent about $100 million on capital improvements (see next section on how this was financed), in a sequence of two-year strategic capital improvement plans. Of this, 75% was spent on "expansion/adjustment", and 25% on "capital renewal" (reducing the maintenance backlog). As of this writing these funds have been spent in full and there is no current pool of funds for capital improvements.

The Superintendent has directed that the strategic capital improvement plans be extended to five years, starting with FY 1991-92. This planning process, the Plan Facility Management Program, is currently underway. It initially consisted of three parts, or phases:

- Phase I - Maintenance Audit - Dated September 1991, this plan covers "capital renewal" work based on facility condition inspections, and projects the expenditure of $33,164,207 over the five years, which is about double the annual spending in the previous eight years. The plan is based on a life-cycle replacement schedule. The source of funds for this Phase is about $2 million annually of maintenance funds, and $3-4 million of capital funds. A more recent draft entitled Capital Program Requirements dated October 1992 projected the seven-year capital needs for "capital renewal" at $49.4 million.

- Phase II - Energy Audit - Dated February 1992, this plan established a goal of reducing annual energy cost by 30% over an eight year period. It establishes an Energy Management Program projected at about $13 million ($1.2 million for energy study and design, about $450,000 for operation and maintenance cost, and nearly $11.4 million for energy conservation measures). The draft Capital Program Requirements dated October 1992 revised the seven-year capital needs for energy management to $24.8 million. A recent program of the State Energy Office and the utility company has made a low interest $20 million line of credit available to Portland Public Schools for upgrading of the energy performance in buildings.

- Phase III - Adaptability Audit - The plan for this Phase is under development, but has not been published as a Phase III summary document. It consists of a Code Compliance Program (including ADA, fire and life safety, seismic, etc.), an Environmental Program (asbestos, lead, radon, etc.) and a Safety/Risk

Management Program. The draft Capital Program Requirements dated October 1992 project the seven year capital needs as follows:

Code Compliance----$19.2 million
Environmental--------$ 6.5 "
Safety/Risk------------$ 1.3 "

Within Code Compliance, current projections are about 30% each for ADA, fire & life safety and seismic, with 10% for the rest.

This Plan Facility Management Program does not include an additional $42.7 of capital funds over seven years currently estimated for enrollment expansion, and an additional $6 million estimated for minor building improvement and minor capital equipment.

The Portland Public Schools Risk Manager works closely with the Physical Plant Division in developing the safety budgets within the facilities budgets with the goal of reducing risks. This collaboration could be extended to the reduction of earthquake risks.

Typical costs incurred or projected have been as follows:

Renovation -- $70/sq.ft. (of area affected)
Maintenance (Capital Renewal) ----------------- $.5/sq.ft./yr (all bldgs)
Energy Conservation ------------------------------ $.16/sq.ft./yr (all bldgs)
-------------------------------- $1.3/sq.ft. total program
Reroofing ------------------------ $60-100/square ($.3-.4/sq.ft. floor area)
Asbestos Abatement ------------------------------- $.06/sq.ft./yr (all bldgs)
------------------------------- $4/sq.ft. total program

Seismic

Seismic improvement is included within the Code Compliance Program, of which it currently comprises about 30%. The program will entail a seismic analysis of buildings, which will be initiated when DOGAMI's geologic survey is available. The seismic analysis will not require any special budget authority if it can be accomplished within the Physical Plant Division's budget. (The Director has the authority to reallocate funds within his budget.)

Seismic safety is described in the draft Capital Program Requirements dated October 1992 as follows:

> "With the recent change in the seismic zone for western Oregon, the Portland Bureau of Buildings will be requiring structural modifications to buildings that undergo remodeling. [Ed.: Note that this has not yet occurred.] Proactively, the implementation of a program integrated with routine maintenance activity to mitigate non-structural and structural seismic concerns will be initiated in all District facilities.

> This program will not, however, upgrade all facilities to current design standards for earthquake resistance."

The seismic strengthening of non-structural elements currently planned includes parapets, lateral bracing of ceiling systems, large glazing areas and high shelves. These non-structural seismic retrofit measures have been estimated at $3/sq.ft.

Seismic improvement received a boost from the earthquake of March 1993. Following the earthquake every building was examined by custodial staff and observed damage was reported. Thirty percent of the schools were inspected by Physical Plant personnel as a result of these reports. Most of the damage was determined to be superficial, but two closures were directly attributable to earthquake damage in an auditorium and walkways. The latter were in a precast concrete building which current plans will demolish.

Additionally, an archival plans analysis of all the schools was undertaken to identify all load bearing unreinforced masonry buildings. This information was combined with a review and update of the facility condition inspections carried out in late 1991, and summarized in a Facility Profile Summary dated May 1993. In addition to basic data about each school, four "condition rating criteria" were included:

- Code Upgrade Status
- ADA
- Deferred Maintenance
- Seismic Condition (very poor, poor, fair, good)

VI. FINANCIAL AND BUDGET ISSUES

The State of Oregon does not contribute funds for local school construction, capital improvement or facility maintenance. One hundred percent of these expenditures are funded by local taxation or debt.

Property Tax Measure 5 (HB 2550), approved by the voters on November 6, 1990, limited the total taxes and government charges imposed on each property in the state. Measure 5 divides property taxes and charges into two categories: (1) school taxes and charges and (2) non-school taxes and charges. Total school taxes and charges are limited to 0.5% of each property's real market value to be phased in over a five year period (1.5%, 1.25%, 1%, 0.75% and 0.5%). Total non-school taxes and charges are limited to 1% of property value, and are effective in the first year (FY 1991-92).

During the first five years, Measure 5 requires the state General Fund to replace any revenue lost by schools due to the tax limits, provided that total school revenue from property taxes and state replacement does not grow by more than 6% per year. The Superintendent of Portland Public Schools believes that this shift to State funding will become permanent, and that ultimately Oregon will have a "State-funded school system".

In addition, Measure 5 specifically exempted from the limits taxes to repay bonded debt authorized by the state constitution, existing bonded debt for capital construction, and new voter-approved bonded debt for capital construction. Since the passage of Measure 5 there have been several successful bond issues for school capital improvement in Oregon jurisdictions.

This year the State legislature approved a measure to place a 5% sales tax before the voters in November (1993). The measure would abolish property taxes for school operating expenses. The proceeds of the sales tax would be devoted to school funding, would not be earmarked for capital or operational budgets, and its distribution would be subject to an equalization formula.

Portland Public Schools seems to be at a turning point in the financing of its capital improvements. Between 1978 and 1980 the Board failed to obtain voter approval for several bond issues, and until 1984 Portland Public Schools had no bonded indebtedness. In 1984 they had an unfunded pension liability estimated at $700 million, as well as an estimated $200 million in deferred maintenance. The former was interpreted as providing authority to finance up to $700 million without voter approval. In November 1984 they issued $114 million of tax exempt pension bonds under this authority. Subsequently, such pension bonds were prohibited by the U.S. Treasury. By managing the early retirement of the pension bonds, Portland Public Schools realized a cash surplus of $66 million which went into a capital improvement fund (Funds 067 and 068). This was augmented in 1989 by the sale of $40 million of Certificates of Participation in the facility program. Most recently $20 million have become available through the energy program.

Finally, Portland Public Schools currently has almost $1 billion in untapped capital bonding capacity.

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

The idea of incremental seismic strengthening appeared to be well received by all Portland Public Schools personnel who considered it, and it did not seem to present any legal problems. The Risk Manager felt that incremental strengthening would fit into the category of "preparedness", which would be a defense against a real risk of liability in case of an earthquake.

If incremental strengthening were paid for by the proceeds of a capital bond, the work would have to be identified in advance.

VIII. SUMMARY AND OBSERVATIONS

Lessons Learned

1. School district and local government spending in Oregon has been significantly impacted by the passage of the tax limits of Measure 5 and will continue to do so (some have estimated that it will result in up to 20% reduction in spending). However, by exempting taxation for the repayment of bonds for capital construction, the effect of Measure 5 on school capital spending may be limited.

2. Seismic response and mitigation planning are growing activities in various levels of government in Oregon, probably given additional impetus by the earthquake of March 25, 1993.

3. The five-year maintenance and capital improvement planning being carried out by Portland Public Schools is a rational framework for identifying and incorporating seismic retrofit work, which reportedly have already been initiated.

4. The Portland Bureau of Buildings' use of negotiations and formal agreements with building owners to achieve incremental improvements in existing buildings so as to reduce risks provides an effective and replicable regulatory approach to the accomplishment of seismic retrofit. This is because of the growing awareness of seismic risk within the Bureau and in general.

5. The number of unreinforced masonry schools was initially over-estimated by Portland Public Schools personnel. A review of archival plans showed that many of the buildings were brick veneer. This demonstrates the importance of review of archival plans if they are available.

Changes to Improve Seismic Retrofit

Prioritizing the currently identified and additional seismic retrofit work in Portland City Schools should be coordinated with DOGAMI efforts to categorize seismic hazards, and with Metro and city earthquake response planning.

What Can Be Shared with Other Districts

There are four lessons which Portland can share:

1. The Superintendent's commitment to long range strategic planning, with good support from the Board of Education, are the best possible basis for incorporating seismic retrofit into facility maintenance and capital planning. Find ways to generate and nourish this commitment and support.

2. Replicate the sophisticated approach to long range facility maintenance and capital planning.

3. Creative approaches to financing capital improvements should be developed.

4. Employ a non-rigid yet fiscally responsible distinction between maintenance and capital funds, defined by planning objectives.

5. Learn to negotiate incremental risk reduction building improvements with your local building department.

6. A small local earthquake doesn't hurt the cause of seismic mitigation.

APPENDIX A

LIST OF INTERVIEWEES

Portland Public Schools:
- Dr. Jack Bierwirth, Superintendent
- George Collins, Chief Financial Officer (since retired)
- Reg Martinson, Director, Physical Plant Division
- J. R. Bloch, Risk Manager
- Jim Clark, AIA/CSI, Manager/Architect

Bert Kile, Portland Emergency Management Office (since retired)
Margaret Mahoney, Portland Building Department
Mike Haggerty, Portland Building Department
Roger W. McGarrigle, Van Domelen/Looijenga/McGarrigle/Knauf
David Mayer, Oregon Emergency Management
Patrick Lee, Regional Planning Supervisor, METRO
O. Gerald Uba, METRO

APPENDIX G

OGDEN CASE STUDY

October 29, 1993

I. DISTRICT INFORMATION

There are about 12,600 pupils attending over 22 public schools occupying 26 buildings in Ogden. There are 15 elementary schools, four middle schools and three high schools (including one alternative high school). The public schools are owned and administered by Ogden City Schools.

The average age of an Ogden school building is 38 years, and the oldest building still in use was built in 1909. One building was demolished in the past ten years. The school population has grown by an average of 1.1% over the past seven years, but the present school capacity still exceeds the occupancy by several thousand due to earlier decline in school population. Up to four of the school buildings are reportedly unreinforced masonry bearing wall construction. The rest are steel or reinforced concrete frame. There is an apparent extensive use of masonry infill, masonry cavity wall and masonry veneer.

The annual public school budget in Ogden is about $37.5-million. (The average expenditure per pupil in the State of Utah is reportedly the lowest among the 50 states, which is attributed in part to larger average family size. The average expenditure per pupil in Ogden is $2,800-2,900.) A capital improvement program was initiated by Ogden City Schools about six years ago and a $10-million bond issue was passed. This amounted to about 1/2 of the estimated deferred maintenance needs. The plan is reportedly 85% complete.

The State of Utah Division of Risk Management in the Department of Administrative Services maintains and manages a risk pool covering the public schools. The school districts are assessed contributions to the pool, and the Division of Risk Management self insures a relatively high deductible and purchase insurance for losses in excess of the deductible. The Division of Risk Management is becoming increasingly involved in facility-related risk management of Utah's schools, including encouraging adoption of loss reduction measures by local districts.

II. WHY OGDEN WAS SELECTED

The State of Utah and the Wasatch Front have received particular attention under the National Earthquake Hazards Reduction Program (NEHRP), and it was the intention of this project from the start to include a district in that region. Salt Lake City, presumably the obvious choice, was seriously considered since it had recently carried out a seismic vulnerability study of its public schools, had defined a long range seismic rehabilitation program, and had passed a bond issue to implement the program. However, the program reportedly became entangled in Utah's school capital budget equalization efforts (see below), and the political implications of that situation appeared to be too complex and localized for inclusion in the study. We believe that Salt Lake City's experience with seismic mitigation in schools contains many valuable lessons for the rest of the country, but the resources available to this project would not allow for their research and elaboration.

Five other Utah districts were surveyed, four of which are in the Wasatch Front region, and one in south-western Utah. Two of the districts indicated their willingness to participate in the study: Ogden and Iron County. The choice was difficult, since the average age of the school buildings in both districts was almost the same. Ogden was finally selected because of its higher seismicity (Zone 3 vs. 2B of the Uniform Building Code) and its older urban context.

III. SEISMIC AWARENESS AND POLICY

Utah has experienced 13 earthquakes causing damage (MMI = VI or higher) in this century. Several buildings were damaged in each event.

In September 1990 we reported to FEMA a series of state and local case studies which included Utah, Salt Lake City, Provo and Ogden (FEMA-199/September 1990, "Financial Incentives for Seismic Rehabilitation of Hazardous Buildings--An Agenda for Action, Volume 2--State and Local Case Studies and Recommendations", pp.65-87). Regarding seismic awareness and policy:

> "There is a general level of awareness of the earthquake hazard in Utah, which has increased significantly as a result of Loma Prieta. Fifteen thousand people attended a recent earthquake exposition--"After the Shock"--sponsored by the media and Salt Lake County. Everyone living on the Wasatch Front is apparently aware of the Wasatch Fault... However, despite the high and growing level of seismic awareness in Utah, political support for seismic programs at the State level is very low.
>
> In 1977 the Seismic Safety Advisory Council was established by the State legislature. It was charged to recommend a consistent public policy framework for earthquake hazards reduction in Utah.
>
> By 1981 the Seismic Safety Advisory Council (SSAC) had published 22 reports and publications...
>
> Few if any of the SSAC's recommendations were implemented, and the Advisory Council itself was disbanded shortly thereafter.
>
> The Governor's recommended Executive Budget for Fiscal Year 1990 did not mention earthquake safety, and seismic improvements cannot be specifically identified in the Capital Budget, which includes new construction and renovation items."

An informal group of public officials has been keeping the seismic issue alive, but state seismic legislation proposed has generally been defeated.

The FEMA report continued:

> "There are several possible explanations for this unusual combination of high awareness of seismic risk with low political support for mitigation action:
>
> - Economic Context - The 1980s marked a steep economic decline in Utah, from which it has been slowly recovering in the past two years. (Note: Today, 1993, the economy is slowly growing.) State budget priorities lie elsewhere. Legislative proposals by the Division of Comprehensive Emergency Management have reportedly been blocked by the State budget analysts.
>
> - Laissez-Faire Mentality - Utah is noted for its laissez-faire, anti-planning mentality. Some have stated that planning, in the mind of Utahns, is akin to communism. There is no strong central planning at the State level.
>
> - Fatalism - Several times we encountered the statement that earthquake is an "Act of God," and therefore cannot be avoided or mitigated. This view may be supported by the Church of Latter Day Saints, which advocates preparation for the disaster aftermath (food reserves, 72-hour packs, etc.), and volunteerism for post-disaster relief operations, but not, apparently, pre-disaster mitigation.
>
> - The Floods of 1983 - During the floods of the early '80s, the Governor of Utah implemented a project which constructed pumps on the Salt Lake, at great expense. Subsequently, the level of the lake receded naturally and the pumps have not been used. The message is evidently not lost on Utah politicians: no more allocation of major financial resources on a potential natural disaster."

With regard to Ogden, the FEMA report stated:

> "...seismic issues are generally viewed as being addressed by the building code and building regulatory system...
>
> The building regulatory system has been struggling for several years with the application of the building code to existing buildings undergoing rehabilitation or change of use, and two local ordinances have been developed in the past six years to address this issue. Aside from this, not much attention is paid in Ogden to the mitigation of seismic hazards in existing buildings. In fact, earthquakes have not been a priority in Ogden, though this may be changing. However, there are many higher priorities competing for resources which cannot keep up with the city's deterioration."

These observations of three to four years ago are still generally valid. The Ogden Fire Chief, who is currently responsible for emergency management, considers earthquake as the "most devastating risk for Ogden". While he is concentrating on an all-hazards approach to disaster response, he believes there is a need for seismic mitigation in buildings.

Seismic awareness in the schools community is high. Several Ogden City Schools personnel, including the Superintendent, described Ogden as being in a zone of high seismic risk. They are aware of Utah's preparations for a forthcoming "Response '93" earthquake exercise, though it was unclear if Ogden will have any role in it. Emergency plans are in place in every Ogden school.

However, seismic risk is not a high priority for Ogden City Schools, and there is not much discussion about it. Even though one school official expressed his opinion that all of Ogden's school buildings would "come down" in an earthquake, the general attitude seems to be summarized by "there is not much we can do about it". None of the Ogden City Schools personnel with whom we met suggested the likelihood of initiating a seismic mitigation program, even one limited to screening of the buildings. The reason given is the firm conviction that financial resources from any source will not be available to complete a seismic retrofit program, and that initiating a program that cannot be completed may entail liability. These sentiments may reflect both the limited financial resources available to Ogden schools as well as a general fatalistic point of view.

IV. REGULATORY BACKGROUND (CONTEXT)

Code Development and Maintenance

A state law passed in 1987 (Utah Uniform Building Standards Act) requires that the state and each political subdivision of the state adopt the Uniform Building Code (UBC). The law is administered by the Division of Occupational and Professional Licensing. The Division adopts by rule the specific edition (and successor editions) of the codes to be used. Currently use of the 1991 edition of the UBC is mandated.

The legislation established a Building Code Commission in 1989 with the following duties:

- Recommend editions of the codes to be adopted by rule.
- Recommend amendments to the codes to be adopted by rule.
- Offer opinions regarding interpretation of the codes.
- Act as an appeals board.
- Establish advisory peer committees.
- Assist the Division in overseeing code related training.

Code amendments adopted by rule may be statewide or local. The law stipulated that existing code amendments made by any jurisdiction prior to 1989 shall remain in effect until July 1, 1991.

A statewide code amendment which could have significant impact on incremental seismic retrofit was adopted on January 1, 1993. The amendment added the following to Section 104.(b) **Additions, Alterations or Repairs** of the UBC:

> " Buildings constructed prior to 1975 with parapet walls, cornices, spires, towers, tanks, signs, statuary and other appendages shall have such appendages evaluated by a licensed engineer to determine resistance to design loads specified in this code when said building is undergoing reroofing, or alteration of or repair to said feature.
>
> EXCEPTION: Group R-3 and M occupancies.
>
> ...When found to be deficient because of design or deteriorated condition, the engineer shall prepare specific recommendations to anchor, brace, reinforce or remove the deficient feature.
>
> The maximum height of an unreinforced masonry parapet above the level of diaphragm tension anchors or above the parapet braces shall not exceed one and one-half times the thickness of the parapet wall. The parapet height may be a maximum of two and one-half times its thickness in other than Seismic Zones Nos. 3 and 4. If the required parapet height exceeds this maximum height, a bracing system designed for the force factors specified in...for walls shall support the top of the parapet. When positive diaphragm connections are absent, tension roof anchors are required..."

Interestingly, this amendment was modeled after a 1986 Ogden ordinance. As an Ogden ordinance it did not apply to public schools, while as a statewide amendment it does. Ogden City Schools personnel were apparently not yet aware of this amendment in April 1993.

Finally, the Uniform Code for Building Conservation (UCBC) is not currently adopted in Utah by law or by rule, although adoption is under discussion. Its use is currently voluntary and as a training document.

Code Enforcement

The Utah Uniform Building Standards Act places responsibility for code enforcement with the "compliance agency having jurisdiction over the project". The act defines "compliance" agency as an agency of the state or any of its political subdivisions which issue permits for construction regulated under the codes, or any other agency of the state or its political subdivisions specifically empowered to enforce compliance with the codes.

School districts in Utah are autonomous, and cities and counties do not have jurisdiction over public schools within their boundaries. School construction and major renovation plans are reviewed by three state agencies:

- State Fire Marshal
- Utah State Building Board

- Department of Health

Final approval is given by the local School Board. The state plan review is reportedly quite general and non-technical, and no code enforcement inspections are carried out by any of the state agencies. As a result, building code enforcement in schools has implicitly been left in the hands if the school districts and their architects/engineers, and has therefore reportedly been rather uneven.

A recent amendment to the Utah Uniform Building Standards Act has addressed the quality of code enforcement statewide. Section 58-56-9. states:

> "(1) Effective July 1, 1993, all inspectors employed by a local regulator, state regulator, or compliance agency to enforce provisions of the codes...shall:
> (a) meet minimum qualifications as established by the division...or be certified by a nationally recognized organization which promulgates codes adopted under this chapter, or pass an examination...;
> (b) be currently licensed by the division...
>
> ...
>
> (2) A local regulator, state regulator, or compliance agency may contract for the services of a licensed inspector not regularly employed by the regulator or agency.
>
> ..."

Ogden City Schools is aware of Section 58-56-9, and as its own "compliance agency", intends to have its in-house inspectors become certified by the International Conference of Building Officials (ICBO), which promulgates the UBC and tests/certifies inspection personnel.

As noted earlier, the State Division of Risk Management is becoming increasingly involved in facility-related risk management of Utah's schools. The division has increased its staff significantly in the past 18 months, including the addition of a professional engineer. It has initiated two types of inspection programs--self-inspection and division inspection:

- The self-inspection program occurs in state buildings, colleges and schools. It covers a variety of non-structural hazards including seismic hazards. The achievement of "substantial" corrections results in a credit on the required insurance pool contribution. The intention is to initiate surveys next year of unreinforced masonry buildings and older buildings constructed prior to the adoption of building codes.

- State Division of Risk Management inspections are carried out by four inspectors who spend all their time in the field. Each elementary school in the state is reportedly visited by an inspector every 2-3 years. The inspections may result in recommendations which could affect insurance coverage.

While neither of these programs is strictly related to code enforcement, they may lead to incremental seismic retrofit of schools by encouraging the adoption of loss reduction measures by local districts.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

Capital improvement and maintenance of Utah schools are reportedly operating under very restricted budget conditions.

The previous administration of Ogden City Schools evidently had a long range plan including capital improvement. It also, reportedly, deferred much maintenance. Six years ago the new administration undertook a needs survey which led to changes in the earlier long range plan. Needs totaling $20 million were identified, and a $10 million bond issue for improvements and upgrades was passed. Reportedly, 85% of the anticipated improvements and upgrades have been completed to date.

Today, according to a senior Ogden City Schools official, long range planning (i.e., planning with a 5-10 year time horizon) is limited or non-existent in Ogden schools. While the "needs plan" is generally followed, facility problems or needs are addressed as they arise. The distinction between maintenance and capital improvement is vague, and is made by administrative decision. Small projects are paid under the Maintenance and Operation (M&O) budget. "Big ticket items" (over $10,000) are paid from the $10 million bond. (By this definition, reroofing can be either a maintenance item or a capital item depending on the size of the project.)

The hard costs of new school construction in Ogden is reportedly $65-75 per square foot. Renovation is reported at about $55-65 per square foot. The cost of maintenance is estimated at $1.50-2.00 per square foot.

Ogden City Schools has committed $100,000 for asbestos abatement in 1992-93, and estimates the need for a 3-5 year program at $300,000-500,000 to complete the job. Averaged over the total area of school buildings, this comes to $.20-.33 per square foot. A similar budget is currently being projected for compliance with the accessibility requirements of the ADA.

A recently completed reroofing project at Washington High School (built in 1921 and 1956), paid for by bond funds, incorporated the anchoring of masonry walls to the roof structure. The latter work was apparently suggested by the architect/engineer in order to follow the Ogden statute voluntarily. The project costs were:

- Remove and replace roof-------------$2.75 per square foot
- Add wall anchors (@ $50/anchor)--$0.39 " " "

(It is assumed that these costs are per square foot of roof).

This is the only example of seismic retrofit work carried out in Ogden schools.

VI. FINANCIAL AND BUDGET ISSUES

Capital Budget

Until two years ago, Utah school districts were entirely on their own in terms of capital budgets. There was no state participation. Districts could raise capital funds by taxation or borrowing. As stated earlier, Ogden raised $10 million in a bond issue.

Two years ago the state entered the arena of capital funding for local school districts with the enactment of the Capital Outlay Equalization Act (H.B. 65), which later became known in some urban circles as the "Robin Hood" bill. Under this act two or three districts put up most of the capital funds which were redistributed by the state in accordance with a complex formula. H.B. 65 did nothing to encourage seismic mitigation; quite the contrary. It was reportedly as a result of this act that Salt Lake City lost the funds earmarked for renovations including seismic retrofit which were raised in a bond issue. Ogden was not a recipient of capital equalization funds under H.B. 65, but was rather a payee.

Opposition to H.B. 65 led to its replacement by the very recently enacted S.B. 1, which is viewed by Utahns as being at the national forefront of capital equalization for schools. The core of S.B. 1 is a new minimum state contribution as follows:

- $2.4 million In FY '93 (in addition to $4.958 million appropriated under a separate act)
- An additional $2.85 million in each of FY '94, '95 and '96 (totaling at least $14.558 million by the end of FY '96)

The act stipulates that the source of funds for the state contribution shall be the reduction or elimination of sales tax exemptions.

The details of the capital equalization program are complex and beyond the scope of this case study. A copy of S.B. 1 and explanatory charts dated April 2, 1993 are appended. Districts must levy the statutory capital outlay debt service maximum (0.24% of taxable value) to qualify for capital equalization. The program has two basic components--foundation and critical & continuing aid. The foundation program is equalized among districts on the basis of a formula which allots 70% to the assessed valuation per student, 10% to growth as related to unhoused students, 10% to the tax rate for capital outlay and debt service, and 10% to outstanding and authorized bonded indebtedness. The foundation funds can be used for a variety of expenditures. Critical & continuing state aid is distributed on the basis of a variety of measures of financial and physical need, including a district's being at 95% of its bonding capacity. Critical & continuing aid funds can only be used for buildings, land and debt service.

The amount of a district's capital equalization funds will change the district makes decisions about a variety of factors, such as:

- Issuance of new bonds--A district which currently does not qualify for critical and continuing aid may issue bonds and qualify for aid; a district which is currently eligible for aid may issue new bonds and be eligible for increased aid.

- Changed levies--A district may raise levies to qualify for participation in critical and continuing aid; a district may lower levies and become ineligible for such aid.

- Local decision making--A district may make decisions about use of school buildings which may make it ineligible for critical or continuing aid, such as decisions about the use of year round schools.

- Assessed valuations--As assessed valuations change, the average assessed valuation per student will change and this will affect the ability of a district to qualify for aid under the critical and continuing program or the foundation program.

- Student growth or decline--As the number of students in a district changes, the eligibility for aid may change due to a change in the growth rate or due to changes in assessed valuation per student.

Two facts are noteworthy from the perspective of this case study:

- The measures of need which are used in the capital equalization program are spelled out in the act. Seismic vulnerability is not one of them.

- Ogden is a net contributor to the foundation/equalization fund. The impact of continuing & critical aid on Ogden is unclear.

Maintenance Budget

School district maintenance budgets are part of the Maintenance & Operation (M&O) funds. The State of Utah contributes about 75% of M&O funds statewide, and it is reportedly the most "equalized" state in terms of M&O funds. Every school district must levy about 0.4275%. The excess over about 0.4% is recaptured, combined with state income tax funds, and redistributed on the basis weighted pupil units (WPUs). Additional local levies for M&O funds may be imposed by School Board or voter actions.

Special Appropriations

In the recent past limited federal and state funds were made available to districts, including Ogden, for asbestos abatement. These funds reportedly covered about 50% of the cost of asbestos abatement in Ogden.

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

As stated earlier, Ogden City Schools personnel appear reluctant to initiate a seismic mitigation program in part because of a fear of liability should hazards be identified and remain unmitigated due to a lack of resources.

VIII. SUMMARY AND OBSERVATIONS

Lessons Learned

1. Utah is a state which is heavily involved in the funding of local school districts. It has traditionally been a major contributor of local M&O funds, and more recently it has become a contributor of capital improvement funds. In attempting to deal with equalization and to establish a balance in the state's contribution to the various districts, it has come up with various formulas to define a district's needs. Seismic vulnerability is not currently a factor in the needs definitions. However, if this were to change, state supported capital equalization could become a significant incentive for seismic mitigation.

2. Seismic mitigation in Ogden schools seems likely to occur only with incentives or inducements from the state or federal governments. In Ogden itself there are currently no stakeholders or advocates arguing for seismic mitigation in schools. But for a state which, for a variety of reasons, has resisted the development of a seismic mitigation policy and programs, potential sources for seismic mitigation were found in two unexpected places:

   - Division of Occupational and Professional Licensing, Department of Commerce----A recent amendment to the UBC adopted by the Division in the Utah Uniform Building Standard Rules requires specific seismic analysis of elements of old buildings undergoing a reroofing. With this amendment Utah may have become the first state to adopt a statewide trigger for seismic retrofit of existing buildings, and since every existing building sooner or later undergoes a reroofing, the trigger is close to a simple retroactive requirement.

   - Division of Risk Management, Department of Administrative Services----The Divisions's initiation of inspection programs which identify loss reduction opportunities and offer insurance rate reductions for their implementation, and the inclusion of some seismic vulnerability factors in these programs, could develop into a force for seismic mitigation in school buildings.

Changes to Improve Seismic Retrofit

Ogden City Schools will move into incremental seismic retrofit as the preceding two actions by divisions of the state government begin to take effect.

Specifically, since all of Ogden's school buildings were constructed before 1975, Ogden City Schools may wish to develop a long range reroofing plan in order to prepare for the seismic analysis and retrofit now required by the building code.

What Can Be Shared with Other Districts

There are three lessons which Ogden can share, now or in the near future:

1. Don't be blind-sided by changes in the building code, especially when the process is controlled by the state, and when you (the school district) are in effect the code enforcement authority. Such changes may force a district into involuntary seismic retrofit.

2. Look for insurance rate reductions which may be offered in exchange for seismic mitigation measures, and which may offset some of the costs of these measures. If such reductions are available, seismic mitigation measures should be brought to the attention of district facility management personnel.

3. The cost of anchoring exterior masonry walls and parapets can be reasonably accommodated in school capital improvement budgets.

APPENDIX A

LIST OF INTERVIEWEES

Ogden City Schools:
  Dr. James L. West, Superintendent
  Larry Tesch, Business Manager
  Robert Amundson, Director, Risk Management
  Ronald V. Worwood, Supervisor, Buildings & Grounds

Jon R. Williams, Fire Chief, Ogden Emergency Management
Alan F. Edwards, Utah Division of Risk Management
Bruce A. Spiegel, Utah Division of Risk Management
George (Jud) Weiler, Utah Division of Occupational and Professional Licensing
Jay Jeffery, Utah Department of Education

ATTACHMENT H

NEW YORK CITY CASE STUDY

October 29, 1993

This document is not an official release by the New York City Board of Education.

I. DISTRICT INFORMATION

New York City public schools are governed by the Board of Education of the City of New York, and administered by a Chancellor. The Board of Education is a creature of the State of New York, and as such is not subject to all New York City regulations. The school buildings, however, are owned by New York City.

There are about 1,000,000 pupils attending over 1000 public schools in New York. New York City is comprised of five boroughs: Brooklyn, Bronx, Manhattan, Staten Island and Queens. Elementary and intermediate schools in the five boroughs are divided into 32 school districts. Each of these districts has an elected board and a superintendent. Approximately 110 high schools are under the Board of Education, and are classified by the five boroughs.

The average age of a New York City school building is 56 years. While the school building inventory is aging and deteriorating, the school population is growing all the time, as a result of immigration. In general, older school buildings are steel frame with solid wall masonry infill. More modern construction is typically steel frame with concrete floors on metal deck. In the 1960s construction was typically reinforced concrete with cavity walls.

The annual public school budget in New York City is about $7-billion. A major capital improvement program (to be discussed in more detail later) was established by State legislation in November 1988, and about $4.3 billion were subsequently appropriated for the first five years of capital improvements.

New York City insures the Board of Education and defends the Board against potential liability. The City does not, reportedly, exercise risk management relating to school facilities.

II. WHY NEW YORK WAS SELECTED

New York City was not among the initial school districts surveyed for potential inclusion in this study. It was assumed that the perceived earthquake risk was too small, that public schools in New York were overwhelmed by many competing and far more urgent problems, and that New York was too complicated. However, we were approached by facilities personnel of New York public schools who had heard of the study. Following some initial discussions, they expressed their interest in being included in the study. This interest was related to the discussions surrounding the adoption of a new seismic building code in New York City (see further discussion below).

In addition to this expression of interest, recent administrative changes in facilities management of public schools in New York City have engendered sophisticated and innovative approaches. At this point it was decided that New York City, the largest public school district in the country, could not be excluded from the study.

III. SEISMIC AWARENESS AND POLICY

There has been no recent earthquake damage in New York City, and there is no general awareness of seismic risk in New York City or New York State. Such awareness is pretty much limited to the earthquake professionals and a handful of engineers. However, the presence of the National Center for Earthquake Engineering Research in New York State, and the desire not to be preempted by a State seismic code at some future time, have led to the development of the New York City Seismic Code, which began four years ago.

The proposed code's most recent version, dated 18 April 1991, is currently awaiting action by the City Council. It is intended that the proposed code apply to new construction only. Existing buildings will reportedly be addressed at a later date.

In recognition of these developments, the Board of Education's Division of School Facilities required in 1990 the inclusion of seismic design in three new school buildings then being designed. This was done both in anticipation of the adoption of the new code, as well as in order to receive information on the incremental cost of seismic design and construction.

Earthquakes are probably not subject to disaster-specific emergency management measures in New York City. Schools are considered to be potential shelters in case of disasters, and staff of the Board of Education attend City emergency management meetings. The seismic vulnerability of the school buildings has not come up as an issue in this context.

IV. REGULATORY BACKGROUND (CONTEXT)

Code Development and Maintenance

New York State has developed and maintained its own building code, which is not applicable to New York City.

New York City has always developed, maintained and enforced its own building code. The most recent code was extensively revised in 1968, and has been continuously updated since then.

Regarding existing buildings, substantial renovation exceeding 60% of the building's replacement value triggers a requirement to bring the building up to present day code. Renovation valued at 30-60% of replacement cost needs to comply with the code only in the areas being altered. Lesser renovations need comply with the pre-1968 code. Change of occupancy may trigger specific code requirements, but total compliance is not required.

New York City has traditionally been in the lead as regards retroactive requirements on existing buildings. Such requirements have addressed stair enclosure, egress in places of assembly (signage, sprinklers, fire alarms, emergency lighting and fire department use of elevators), facades of tall buildings, emergency lighting in places of assembly, etc. They are usually enacted as the result of heightened awareness of a particular risk.

The proposed New York City Seismic Code is reportedly based on the Uniform Building Code. The intent of the code is protection of life. Schools, however, are defined as essential facilities in which continued use is also an objective. The proposed seismic requirements will be specifically exempted from the value triggers applicable to renovation, and will not be triggered by a change of occupancy. Department of Buildings personnel stated that specific seismic retrofit requirements, based on analysis of risk, will be developed after the seismic code is adopted.

In addition to compliance with the New York City code and retroactive ordinances, there are various State and Federal mandates which apply to schools in New York City. The conversion of coal burning heating plants (of which over 350 still operate in New York schools) is required to meet State air quality emission standards. State soil contamination requirements affect subsurface fuel tanks. Asbestos abatement has been addressed aggressively by New York City schools since 1978, and the removal of architectural barriers has been given new impetus by the Americans with Disabilities Act.

The most recent State mandate (effective January 19, 1993) has been the requirement for all school districts in the State to conduct annual structural inspections of the instructional buildings, which was brought about as the result of a widely publicized collapse in a windstorm. The requirement is for annual visual inspection of structural elements, to be followed by analysis by an architect or engineer of all apparent defective structural conditions.

As regards educational policy and planning standards, New York City schools have followed their own Manual of School Planning (1971). This document is reportedly to be updated.

Code Enforcement

Enforcement of the building code and various retroactive local laws in New York City is the responsibility of the Building Department which carries out both plan review and inspections with its own personnel. The Building Department's enforcement activities applied to public schools until 1988, when the State Legislature created the School Construction Authority (SCA). Among the other powers granted to the SCA is building code enforcement in public school construction and renovation. (See more on the SCA below.)

In modernization projects (see below) the Board has a policy of bringing the building into compliance with the building code for new construction.

State Reviews

State reviews in New York are limited to programmatic issues in capital plans.

V. CAPITAL IMPROVEMENT AND MAINTENANCE PRACTICES

Capital improvement and custodial maintenance are very separate domains in the New York City public schools. This results from administrative, union jurisdiction and funding factors.

Creation of the School Construction Authority (SCA), Master Planning and Capital Planning

For 12 years----from 1976, when New York City temporarily lost its credit rating, to 1988, when the SCA was launched----the Board of Education was unable to procure adequate funds to carry out routine maintenance of existing schools or build needed new facilities. Lack of funds was compounded by a cumbersome bureaucracy. The result was a rapidly deteriorating inventory of schools.

In April 1987 the Board of Education appointed a 12-member task force on capital financing and construction to examine the physical condition of New York's public school buildings, to develop a long-term capital revitalization plan to reverse the physical deterioration of the schools, and to bring them up to the highest contemporary pedagogical and environmental standards. In addition, the task force undertook to develop the means to fund the plan, to rectify management weaknesses throughout the entire design, construction, and maintenance process, and to eliminate burdensome approvals mandated by other public agencies.

The task force found New York's schools to be in even worse shape than expected. Its inventory of the condition of the buildings revealed overcrowding in over 400 schools, and more than 600 schools requiring major repair work. In many schools children were without drinking fountains, toilets, or playgrounds. Often combination gym/auditoriums were being used to handle student overflow, with one class on stage and several others clustered in the former gym without visual or acoustic separation.

The task force decided that school construction and rehabilitation were beyond the competence of the Board of Education, and concluded that the financial resources which could be raised through New York City capital funds would be sufficient for the board to have its own independent authority. Such an authority, the SCA, was created by the State legislature in 1988.

The legislation exempted the SCA from restrictive regulations and other time delays. No City or State agency could impose its oversight on the work of the SCA. It was released for five years from the State's Wicks Law, which requires agencies undertaking public construction to conduct separate bidding for plumbing, heating, and electrical contracts. The legislation spared the SCA from the City's uniform land use review procedures, land use planning review and approval procedures, historic preservation procedures, architectural reviews, art commission review procedures, and other state or local review and approval procedures governing the use of land and the improvements thereon. The SCA was required to comply with New York City's building, fire and electrical codes.

Prior to the creation of the SCA, every capital improvement project was a budget line item to be negotiated with City Hall. The legislation broke new ground by stating:

> " 10. In any city with a population of one million or more, amounts appropriated to effectuate the implementation of a five-year educational facilities capital plan for such city shall be appropriated as a single item in such city's capital budget in accordance with..."

The legislation proceeded to require that the New York City Board of Education approve an **educational facilities master plan** and a **five-year educational facilities capital plan**, both to be submitted by the chancellor, and to enter into agreements with the SCA to implement the latter. The legislation further defined the following eight **program elements** which must be included in the educational facilities capital plan:

a. New construction.
b. Building additions.
c. Major modernization and rehabilitation.
d. Athletic fields, playgrounds and pools.
e. System replacements.
f. Security.
g. Educational enhancements.
h. Emergency, unspecified and miscellaneous.

Five-Year Capital Plan 1990-1994

The first five-year capital plan requested a budget of about $17 billion and was funded at $4.3 billion by the City Council. The plan was based on a survey of problem schools by four private engineering firms, and on a custodial survey. The plan was broken down as follows ($ 000):

Category I. State of Good Repair	
A. New Construction-Building Replacement	158,350
B. Major Modernization and Rehabilitation	885,050
C. Modernization and Upgrades (10 items)	146,910
D. Rehab of Physical Education Facilities	68,155
E. System Replacements (27 categories)	326,250
F. Swing Space	10,610
Category II. System Expansion	2,113,180
Category III. Educational Enhancements	95,617
Category IV. Safety and Security (9 items)	52,693
Category V. Ancillary Facilities	145,032
Administration	90,700
Emergency, Unspecified	208,025
TOTAL (variation due to rounding)	4,300,575

Of this total, about $2.3 billion is for new building construction and about $2 billion for rehabilitation work in existing buildings.

The above funding levels translated into the following numbers of projects:

63	new schools (including building replacements)
65	modernizations
20	additions
21	additions/modernizations
~2000	individual systems projects

Preliminary Year 2003 Master Plan

The Preliminary Year 2003 Master Plan, subtitled Ten Year Facilities Needs Assessment for the New York City Public Schools, was submitted by the Chancellor to the board on December 23,1992. Its introduction states:

" The Preliminary Year 2003 Master Plan is a facilities needs assessment that details what renovation and construction efforts will be required over the next ten years to provide a healthy, nurturing, welcoming environment for the students and staff of the New York City Public Schools. This needs assessment documents the current and future state of our school buildings by addressing the following three basic questions:

- what is the physical condition of existing facilities and what is required to bring them to a state of good repair by the year 2003?
- what are our projected capacity needs over time and how can they best be addressed so all students have seats in real classrooms and support services can function well?
- how well do our school buildings meet educational program needs, including educational related technology, and what is required to make space flexible to adapt to changing needs and technology over time?

...

This preliminary ten-year needs assessment details the results of a system-wide examination of the current and future facilities needs of the New York City Public Schools. This information is key to substantiating the level of funding required to meet all the needs of the school system over the next ten years and to providing the Members of the Board of Education with as complete a description as possible of the variety of needs of each part of the system.

...

Our data indicates that 85% of our system requires some kind of capital work with 421 buildings requiring modernization. The capital backlog (work needed to reach a state of good repair) is over $7.8 billion. Twenty eight percent of our elementary and middle schools are overcrowded as are virtually all high schools. Over the next ten years, enrollments will increase by thirty four (34) percent resulting in overcrowding in seventy two (72) of all school districts.

The total cost for the Preliminary Year 2003 Master Plan is over $24 billion, in 1992 dollars, summarized as follows:

Category I.	State of Good Repair	$ 7.8 billion
Category II.	System Expansion	$12.7 billion
Category III.	Educational Enhancements	$ 3.1 billion
Category IV.	Safety and Security	$ 305 million
Category V.	Ancillary Facilities	$ 711 million"

This preliminary master plan was to be the subject of hearings held by each Community School Board and the Central Board of Education. Inputs from these hearings was to be incorporated, as appropriate, into the Final Year 1003 Master Plan which was to be submitted to the Board by April 1, 1993.

Needs Assessment Instruments

The task force on capital financing and construction, which recommended the creation of the SCA as well as the development of a master plan and five-year capital plan found that the lack of data on the school facilities was a major problem contributing to all the rest. Since then, New York City Public Schools, under the direction of its Chief Executive for School Facilities, has been developing and using two instruments to collect data and build a data base to remedy this problem.

School Scorecard----The first instrument is known as the School Scorecard. School Scorecard is a management information system that monitors the physical appearance conditions of all school buildings on an ongoing basis. School Scorecard compares classroom conditions to those of previous years, going back to baseline data of 1987-88. Using objective scales and standards, trained inspectors rate conditions in all schools twice a year. The two ratings are averaged to produce the school year scores. The information is used to identify needs, establish priorities, allocate resources, and monitor the effectiveness of maintenance initiatives over time. Scorecard generates lists of schools which rank "worst" in particular maintenance categories. These lists have been part of the Six-Month Maintenance Plan for Skilled Trades.

Scorecard focuses mainly on perceptible damage in classrooms and toilet rooms, and is more a measure of conditions experienced by students and staff than it is an assessment of the architectural integrity or mechanical systems of the buildings. All accessible classrooms are inspected, except that in schools with over 100 classrooms, a 100-room random sample is inspected and rated.

Scorecard uses a seven-point scale from zero to six, with 0 representing virtually no damage, and 6 indicating extreme damage. Scale points are assigned by the inspectors to each of the following attributes: For walls----material integrity, paint condition, and dirt/grime; for ceilings---material integrity and paint condition. The ratings for these five attributes are averaged to arrive at an overall appearance rating. Inspectors also evaluate the following classroom fixtures: lights, floors, furniture, storage items, door operation, door appearance, window shades, window panes and chalkboards. In student toilets the following items are evaluated: sinks, urinals, water closets, stall dirt/grime and the presence of stall doors, soap, toilet paper and paper towels.

The schools with the worst overall appearance ratings are referred to as the "Schools Most In Need." Most of these schools currently have capital renovation projects in progress.

Automated Building Condition (ABC) Survey----The second instrument is known as the ABC survey. Its objective is to evaluate each school in a consistent manner, so as to allow the Office of Strategic Planning to select schools for the five-year capital plan. A full time staff of 25 is engaged in implementing the ABC.

The survey approach is to visit and survey each school with the assistance of the custodian and the school staff. The 4-person survey teams consist of two architectural inspectors, one mechanical inspector and one electrical inspector. The architectural inspectors split up with one starting on the exterior elements and the other on the interior elements. The mechanical and electrical inspectors work independently of the architectural inspectors. All elevators and escalators are surveyed separately by an elevator inspector.

The evaluation is based on breaking down the school into smaller components and rating them. Various components a weighted to arrive at an overall rating for the school. The scope of the survey is as follows:

- 15% of all classrooms or a minimum of 10.
- All public assembly areas (gyms, auditoriums and lunchrooms).
- One special use room in each category (library, shops, labs and music).
- All attic spaces.
- 50% of toilets.
- 50% of the stairwells.
- Entire basement/cellar area.
- All exterior components, including playyards.

A computerized survey form is developed for each component which identify specific items to be evaluated. Each item is rated using a five-point scale from 1 (inoperative) to 5 (excellent). These ratings are used to indicate the amount of repair required to bring the item to a state of good repair:

- 1-inoperative: total replacement.
- 2-poor: 50% repair/replacement.
- 3-fair: 20% repair/replacement.
- 4-completely serviceable: minor repairs.
- 5-very good/excellent: operating as designed with no deficiency, and age is within item's useful life.

Observed hazardous conditions and potential violations are noted, and subject to special processing.

Each school survey begins with an interview with the principal to obtain information on top facility priorities and on the presence of any art in the school. An interview with

> the custodian is intended to obtain information on problem areas in the building. A history of previous repairs and replacements is documented.
>
> After each survey is completed in the field, it is reviewed and entered into the ABC System. This allows the survey data to be manipulated into various types of reporting levels from individual schools to citywide comparisons. Ultimately it develops the Board of Education Master Plan, the Five-Year Capital Plan and Annual Lump Sum Work Plans.
>
> The annual structural inspections mandated by recent state legislation and mentioned earlier are reportedly being integrated into the ABC survey.

The ABC System was used to develop the portion of the Preliminary Year 2003 Master Plan addressing existing facilities needs by identifying modernizations, system replacements and building replacements.

Modernization needs were identified in one of three categories: Exterior, Interior and Full modernization. The ABC ratings of the following elements were examined:

Exterior
- roofs
- windows
- masonry
- parapets

Interior
- boilers
- plumbing
- electrical systems
- heating/ventilation
- temperature control

If three elements in either category were rated less than or equal to 3.5, that school was identified for an interior or exterior modernization. If a school qualified for both, it was put into the full modernization category.

For all other buildings not requiring modernization, individual system replacement needs were identified using the same methodology with the following categories of elements:

- roofs
- parapets
- exterior masonry
- windows
- electrical systems
- heating plant upgrade
- HVAC
- piping/plumbing
- student toilets
- staff toilets
- flooring
- paved areas - blacktop
- paved areas - concrete
- playground redevelopment
- fencing
- boiler conversion
- climate control
- low voltage electrical
- intrusion prevention
- elevators

Building replacements were identified by averaging the interior and exterior overall ratings and by the age of the buildings. All buildings with a combined overall rating of less than 3 which did not have landmark status and were built before 1920 were identified as needing replacement.

Costs of Capital Improvements

The hard costs of new school construction in New York City is reportedly about $250 per square foot. Modernization varies with the market, but is reported at about $100 per square foot.

The costs of selected individual system replacements included in the Preliminary Year 2003 Master Plan, based on reported average areas of typical elementary, intermediate and high schools, are as follows (in 1992 dollars):

Boiler conversion	$1.50-2.50 per square foot
Climate Control	0.10-0.15 " " "
Electrical lighting fixtures	1.00-2.00 " " "
Roofs	1.85-2.65 " " "
Parapets	0.30-1.00 " " "
Windows	2.90-5.40 " " "
Exterior masonry	0.65-1.20 " " "
Heating plant	0.11-0.18 " " "
H/V distribution	0.85-1.90 " " "
Plumbing piping	1.30-1.75 " " "
Student toilets	0.25-0.55 " " "
Floors	0.55-1.25 " " "

Maintenance

Maintenance is carried out by custodial staff and contract, and it is financially and administratively separate from capital improvement. Maintenance work is reportedly carried out in accordance with a sequence of six-month maintenance plans. The annual maintenance budget is $20 million, and it has not changed since 1989 when the Five-Year Capital Plan, which added almost 1.5 million square feet to the physical plant, was initiated. Thus, the backlog of deferred maintenance, estimated at $500 million, continues to grow.

V. FINANCIAL AND BUDGET ISSUES

Capital Budget

Under the previous system every capital project was a line item in the City budget. Now the school capital budget process is spelled out in the State legislation of 1988:

" 4. Following approval by the city board of a five-year educational facilities capital plan, the chancellor shall transmit such plan to the mayor, the board of estimate and the council of the city of New York. After consultation with the chancellor and the city board, the mayor shall include in the city's executive capital budget for the fiscal year in which the five-year plan is to commence an appropriation for educational facilities in an amount he recommends as sufficient to provide for the funding of a five-year capital program for the city board and shall specify amounts for each fiscal year within such five year period. Such five-year appropriation, which shall specify the annual amounts for each fiscal year to be made available, shall be subject to adoption, veto and, except as hereinafter provided, amendment in accordance with the procedures set forth in the charter of the city of New York. Upon adoption of a five-year appropriation pursuant to such process, the capital program of the city board shall, if the amount so appropriated differs from the cost estimated in the plan approved by the city board, be amended to reflect the funding so provided. No reduction shall thereafter be made by the city in the amount of such appropriation until completion of the plan unless (i) the city board shall so recommend or (ii) a general, across-the-board reduction is made in the city's capital appropriations in order to accommodate an unforeseen reduction in the availability of city capital funds. In the event the city board so recommends or such a reduction is made, the appropriation may be reduced in accordance with such recommendation or proportionately to the reduction in the city's general capital appropriation. In the event he city board requests additional appropriations from such city during the five-year period of the then effective plan, the city board shall specify the needs to be met by such additional appropriations. The city may appropriate additional amount for the five-year educational facilities capital plan, provided that in no event shall such an additional appropriation be conditioned upon a reduction or alteration of the five-year plan then in effect. The authority may not spend more in any fiscal year of the capital program than the amount specified in the five-year city appropriation therefor, as amended from time to time; provided that any amounts not expended during a fiscal year may be expended in any succeeding fiscal year, and provided further that the mayor may authorize funds to be expended at a rate faster than the amounts so specified, within the balance of the five-year appropriation available therefor.

5. a. The chancellor may in his discretion submit amendments to an approved five-year educational facilities capital plan to the city board for its approval.

b. The chancellor shall submit such amendments in the event (i) the estimated cost of any program element shall increase by more than ten percent from the estimate contained in the plan, (ii) a project will not be commenced within six months from the date set forth in the plan, (iii) a project to be performed at an identified educational facility is proposed to be performed at a different educational facility or (iv) a project not identified in the plan, other than projects to be performed pursuant to ..., is proposed to be initiated."

As this excerpt demonstrates that the capital budget process established in the current legislation demands long range planning, and discourages deviations from the plan once approved and budgeted.

The State of New York's involvement in school capital improvements in New York City goes beyond the creation of a legislative framework. The State has a "building aid" program which reimburses local jurisdictions a portion of the debt service on bonds for school capital improvements and construction. Some jurisdictions get up to 50% reimbursement. New York City's reimbursement is 25%.

Maintenance Budget

School maintenance is totally distinct from the capital budget. It is funded by a City tax levy which is subject to a annual limit. As a result, maintenance funds have remained constant for several years, contributing to the growing deferred maintenance backlog.

Special Appropriations

From time to time New York City Public Schools receive special appropriations from the City or State related to specific building issues. After a recent structural failure of a gable at PS 109 in Manhattan, for example, the board got a $750,000 grant from the City to address the problem.

The city provided a special budget for the schools to comply with the recent retroactive law on emergency lighting in places of public assembly. Finally, New York City Public Schools are seeking a $40 million grant to deal with "sick building syndrome."

VII. LEGAL ASPECTS OF PARTIAL/INCREMENTAL STRENGTHENING

Interviews with Board staff suggested that partial/incremental seismic strengthening could be incorporated into the capital planning process without any legal problems or implications.

VIII. SUMMARY AND OBSERVATIONS

Lessons Learned

1. An orderly long range master planning, capital planning and budgeting process, such as that created by State legislation for New York City, provides the opportunity to identify a variety of building related risks, including seismic risks, and to plan for an orderly approach to mitigate them.

2. The Board has established two periodic facility surveys (ABC and Scorecard), where aspects of the physical condition of school facilities are assessed and recorded. The objective stated by the Board's Chief Executive for School Facilities is to create a comprehensive facilities data base which will guide all future capital planning.

3. Seismic risk reduction in existing buildings is likely to become an explicit objective of New York Public Schools when New York City adopts a seismic code for new construction.

4. The costs of selected individual system replacements included in the Preliminary Year 2003 Master Plan are of the same order of magnitude as the costs of selected incremental seismic improvements.

Changes to Improve Seismic Retrofit

New York Public Schools could approach seismic risk reduction by initiating the following:

1. Initiate and implement a rapid visual screening of the entire school building inventory, so as to enable a characterization and prioritization of the seismic risk.

2. Incorporate elements of a seismic evaluation into the ABC Survey forms. There is an opportunity to accomplish this in the current incorporation of a structural survey (recently mandated by State legislation) into the ABC.

Integration of Incremental Strengthening Opportunities

The following system replacements included in the Preliminary Year 2003 Master Plan could offer specific incremental strengthening opportunities:

- Roofs
- Parapets
- Exterior masonry (walls)

Suspended ceilings, as related to HVAC work, was specifically identified by Board of Education engineers as another such opportunity.

What Can Be Shared with Other Districts

The following six specific features of New York Public Schools can be shared by other districts:

1. The adoption of a local seismic code for new construction can provide the impetus to consider seismic risk reduction in existing schools.

2. The use of annual surveys of school facilities is a necessary first step in long range facility planning.

3. Long range (five-year or longer) master planning, capital planning and budgeting is the most likely way to alleviate the problems of overcrowding and building deterioration in a large inventory of schools. Seismic risk reduction can potentially become an element of long range planning.

4. Parapet deterioration, if unchecked, is a major cause of more general building deterioration. Parapet repair should therefore be identified as a specific element in capital improvement, and seismic bracing of parapets could be economically included in parapet repairs.

5. The structural integrity of gables should be given more consideration than in the past, in light of recent collapses.

6. The recognition of schools as "essential facilities" in the New York City seismic code, and the resultant importance factor in their seismic design is significant.

APPENDIX A

LIST OF INTERVIEWEES

New York City Public Schools:
  Amy Linden, Chief Executive for School Facilities
  Joseph P. Nappi, R.A., Director, Office of Administration, Division of School Facilities
  Jay B. Ames, P.E., Director, Office of Design & Construction, Division of School Facilities
  Two gentlemen from the School Construction Authority

Richard C. Visconti, A.I.A., Assistant Commissioner, Department of Buildings, City of New York
Rick Chandler, P.E., Deputy Borough Superintendent, Department of Buildings, City of New York